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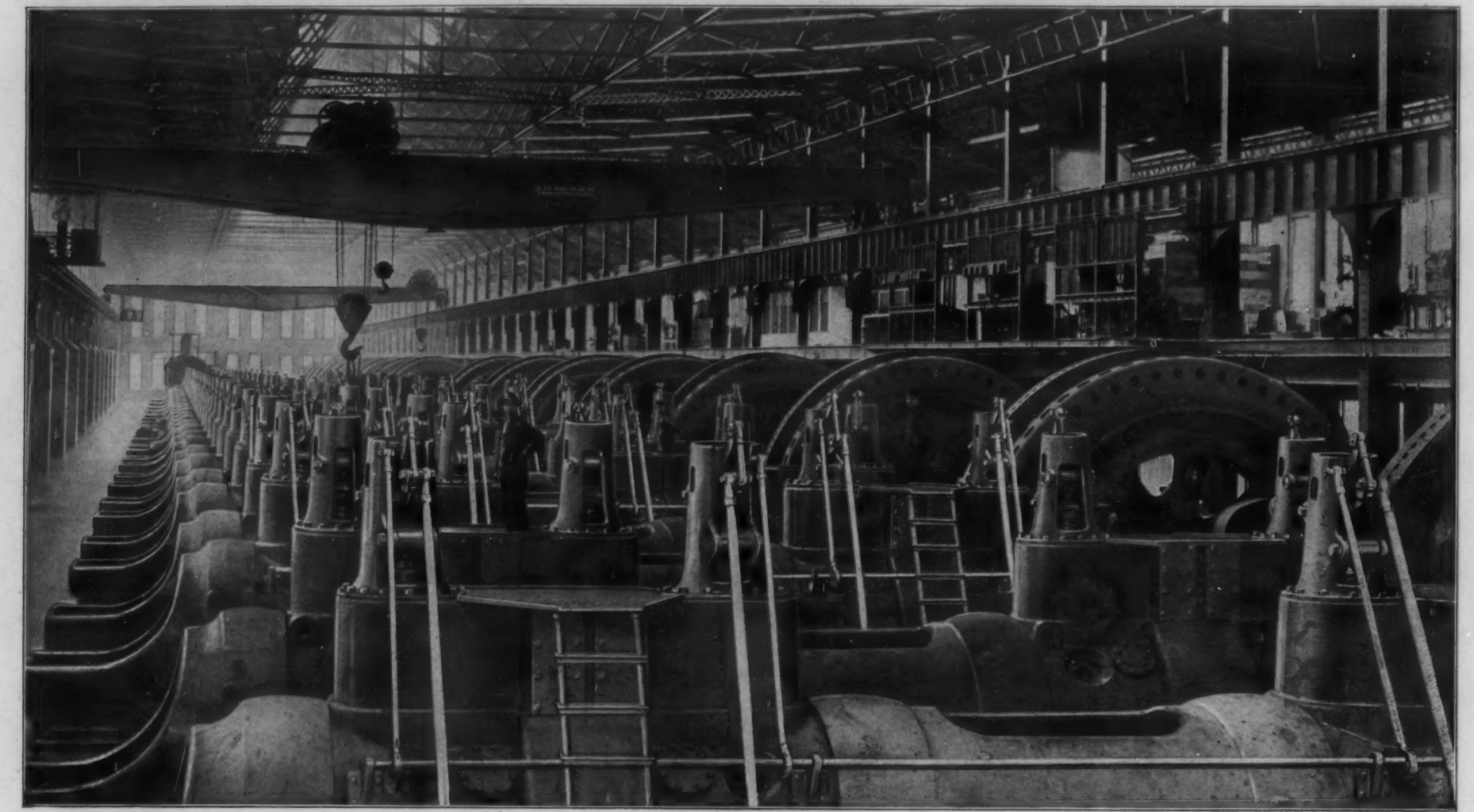

Partial View of Installation at the Indiana Steel Company's Plant, Gary, Ind., where Seventeen Allis-Chalmers Twin Tandem Gas Engines are direct coupled to Allis-Chalmers Generators, each unit being of 2,500 K. W. Capacity

This Illustration is from a photograph taken during erection. The installation also includes eight Allis-Chalmers Twin Tandem Gas-Driven Blowing Engines making twenty-five units in all

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Fig. 1 Backbone of the High Sierras, July Snows and Lakes at the Source of the San Joaquin

THE SAN JOAQUIN VALLEY*

What Electricity Is Doing For This Region Under the Direction of the San Joaquin Light and Power Company

By Clem A. Copeland

Introductory

The land of California is a constant source of pleasant surprises. The proud Native Son as well as the tenderest footed stranger meet on a common ground in California, where a new land is being revealed to both alike. From the weird waste of the valley of the Salton Sink, 287 feet below sea, scarcely 90 miles distant, to the barren crags of Mount Whitney, 15,000 feet in height, there is always something new under the sun. From the pranks of Burbank, with the luscious spineless cactus on the surface, to the 4,455-foot oil well below the surface, there is food for man and beast, and food for serious thought. A State is worth while when it produces 50,000,000 barrels of crude oil a year, thus outdistancing all competitors. Other statistics of too bulky a nature would be a source of pleasure and silent surprise to the one who thinks he knows, but doesn't.

The great, generous valley of the Sacramento and San Joaquin, fifty miles wide, with its 23,000 square miles of fertile, level floor from Redding to Bakersfield, equivalent in area to New Hampshire, Vermont and Massachusetts, will ere long produce a good sized nation's supply of many products of the farm.

As a sample, we may select a small patch around Fresno, the commercial center of the San Joaquin Valley, covered by the system of the San Joaquin Light and Power Company. This comparatively small section, composed of portions of four counties, produced over $41,000,000 worth of necessities the last fiscal year. This amount is derived from raisins, wine, brandies, green, dried and canned fruits; from cereals, hay, live stock and dairy products; from timber and its derived industries; from petroleum and its derivatives; from citrus fruits; and from minerals and clay and the products thereof. The present year will show a marked increase over the figures of previous years.

The newest industry of this section is the propagation of the Smyrna fig, until quite recently a failure. Last year, however, the packing houses around Fresno shipped 6,400,000 pounds of this fruit, due to improvements in pollen fertilization by the importation of the "fig wasp" from its native home with the Smyrna fig.

Thus we find in this fertile district a potent excuse for the electrical development of water powers. Co-ordinate with this demand, there is found an abundance of water, if properly conserved, at exceptionally convenient localities for obtaining high

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Fig. 2 Crane Valley Reservoir and Mountains Forming the Watershed of the North and South Fork in the Upper Distance.

heads, and where climatic conditions are also favorable to the economical generation and transmission of power.

Prosperous California husbandmen and manufacturers are keen and far sighted in resorting to hydroelectric power with an apparently unlimited appetite, notwithstanding the fact that within a stone's throw of the great Kern and Coalinga fields, producing some 30,000,000 barrels per year, crude oil may be obtained

Fig. 3 Crane Valley Dam

for the generation of power at a price equivalent to the best coal at $2.00 per ton.

The system of the San Joaquin Light and Power Company, with its extreme simplicity and reliability, is illustrative of this discussion.

If one could see this system, thus believing, he would travel twenty miles in the crisp morning air, from Fresno across the level floor of the valley to the rolling, oak-clad foothill zone of the Sierra Nevada, through the bull pine belt and further half way across the zone of the sugar pine and cedar,

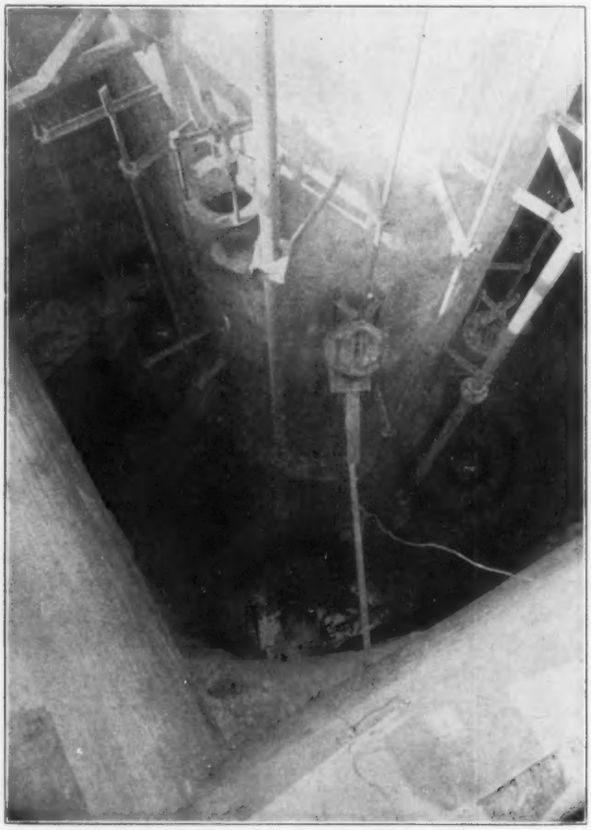


Fig. 4 The New Gate Tower of the Crane Valley Reservoir

when, after fifty-six miles of travel horizontally, and nearly a mile vertically, one is introduced to the quiet

Fig. 5 Ditch, Flume and Tunnel, No. 3 Conduit Line

"Down the Canyon from the Crane Valley dam, beneath the smoky veil in the view in Fig. 2, the conduit extends for 4.22 miles, a part of which is 5 feet wide at the bottom, the remainder being 6 feet in width. The ditch thus formed is in a substantial bed of disintegrated granite the greater part of its length and is plastered with cement."

evening camp, with the smell of the pine and the feel of a nice warm fire.

Crane Valley is discovered at sunrise, a peaceful contrast to "the cares that infest" one's city life.

By the light of the morning sun, the views of Fig. 1 and 2 were obtained, though unfortunately the amber colors of the fall mosaics, set into the forests of pine, cannot be shown, nor the blue of the sky dipped into the deep, quiet waters of the lake.

Crane Valley Reservoir Head Works of Nos. 1, 2, 3 and 4

Fig 6 "Hitting the High Places" on No. 3 Conduit Line, Looking Up Toward Crane Valley.

The dam here shown was constructed in the path of the North Fork of the San Joaquin River where it widens out to form Crane Valley to conserve the winter waters, whereby they may be used in power house No. 3, again eventually in prospective plant No. 2, and finally in the old original plant of No. 1. Behind this dam of hydraulic construction is impounded 4,300 acre-feet of water during the wet months, to produce a sufficient flow for the present 4,600-horsepower equipment of No. 3 and No. 1 power houses, during the months of drouth, when added to the normal summer flow of the North Fork, which empties into the lake two miles up stream.

Unexpected prosperity and enlargements of the system since this dam was built necessitate the construction of a new and larger one at this point. Viewing the photo of Fig. 3, at the extreme left edge, we see where this solid concrete structure will be cemented to the bedrock, fortunately on the surface at this point, just below and adjoining the present dam. The new lake thus formed will be 150 feet deep at the dam, and, due to the very level nature of the floor of Crane Valley, an extensive mountain meadow, the water will extend for five miles up Crane Valley, or up the valley of the North Fork, and will contain 68,000 acre-feet when filled. There will thus be conserved enough water for supplying a power-house capacity of 17,314 kilowatts delivered to the line, in the two present and one prospective power house below, when the South Fork water is emptied into the reservoir in the manner described in the notes on No. 4 power house.

The problem of letting the water out of a reservoir filled to a depth of 150 feet is no small problem. Anticipating the construction of this dam, there is being erected a gate tower at present 66 feet in height, or perhaps we should say deep, at the present time, which will eventually be extended to 151 feet in total height. To start this tower at the bottom of the present lake required a pit 20 feet square near the edge of the lake and near the dam, from the bottom of which the tower is being built. The peculiar view of Fig. 4 was taken looking down the pit on top of the lids of the various valves of different sizes located at different heights, thus admitting water at any desired level. The valve lids are connected with stems which will extend to the top of the tower, where their threaded ends will engage with a hand-wheel-nut for adjusting the opening of the valve. From the bottom of the inside of this concrete tower, 3 feet in thickness at this point, a tunnel 720 feet long extends through flinty blue granite under the present and contemplated dams to a point well down stream on the ditch line. This is the second tower of this kind ever built, its predecessor being constructed to discharge water from the Arrowhead Reservoir Company's reservoir, now being filled to a depth of 250 feet, in the mountains near San Bernardino, California. When completed, this reservoir will be capable of supplying a power-house capacity in the three plants of more than 20,000 delivered horsepower.

Fig. 6a Sand Settling Box on No. 3 Conduit Line.

Prospective Hydraulic Plant No. 4

A study of the map II will show the contemplated power source of plant No. 4 to tap the waters of the South Fork of the North Fork, and by means of a very short conduit and pressure pipe a fall of 1,900 feet is to be obtained, the waters mingling with those of North Fork in the Crane Valley Reservoir, ready for the three power houses below Crane Valley.

Down the canyon from the Crane Valley dam, beneath the smoky veil in the view of Fig. 2, the conduit extends for 4.22 miles, a part of which is 5 feet wide at the bottom, the remainder being 6 feet in width, both parts being 3½ feet in depth and trapezoidal in cross section, with 45-degree sides. The grade of the narrower section is .15 foot per 100 feet, while the wider section conduit slopes .1 foot per 100 feet. The ditch thus formed is in a substantial bed of disintegrated granite the greater part of its length, and is plastered with cement. The capacity when running 3 feet full is 100 second-feet.

Conduit of No. 3 Power House

There are four tunnels on this line, 5 feet wide and 6 feet in height, on a grade of 0.3 foot per 100 feet. The flumes, thirteen in number, are seen in Fig. 5 and 6 to consist of semi-circular steel of 3-foot radius, with a grade of 0.3 foot in 100. Some interesting trouble has been experienced in taking care of changes of temperature in the steel flume, which became great due to the large difference between the summer and winter and the night and day temperatures, co-ordinate with a small flow of water in the day time, when the temperature is high. Canvas "expansion joints" have been found a simple and inexpensive solution of the difficulty.

The unevenness of the country in this canyon may be appreciated from the fact that the tunnels and trestles combined comprise 27 per cent of the total length of the conduit, which thus just "hits the high places" on its way to the pressure pipe of No. 3 power house.

No. 3 Regulating Forebay Reservoir

In the view of Fig. 7 is seen a lake of quite respectable proportions, above No. 3, containing 33 acre-feet or a four hours' supply of 100 second-feet for regulating purposes and in case of accident on the conduit line. This type of reservoir performs an exceedingly useful office in California water powers, where small quantities of water are used under high heads. In the present case, as an instance, a uniform flow in the conduit line from the Crane Valley Reservoir is conserved in this regulating reservoir to accurately fit the conditions of load or any emergency overload over the lighting peak in the power house below, acting thus like a storage battery of 100 per cent efficiency, so that in

Fig. 7 Regulating Forebay Reservoir for No. 3 Power House.

conjunction with needle regulating nozzles there is absolutely no loss of water.

It is readily seen that in an open-conduit line four miles long, with a limited forebay, the flow would necessarily have to be great enough to carry maximum load at all times and the economical feature of the needle regulating nozzle would be lost, by waste of water over the spillway.

In this connection a system of simple and effective design has been devised to indicate the height of water in the reservoir. A bank of lamps in the No. 3 power house, operated in conjunction with a float in the reservoir, is so connected that the lamp burning indicates the number of feet of water in the reservoir 3,000 feet away. As the water lowers, one after another of the lamps are lit upon passing the even foot mark.

No. 3 Pressure Pipe Line

The water from the regulating forebay reservoir, described above, is taken into the pressure pipe line through a tunnel 20 feet below the overflow grade line, the upper end of the pipe consisting of a taper fitting 20 feet in length, being under the full pressure of the depth of water in this reservoir. The taper fitting, 60 inches and 52 inches in diameter, of 3/16-inch steel, conducts the water through a gate into the 52-inch pipe line 3,131 feet in length to the power house 401 feet below. The pipe is of the uniform diameter of 52 inches and divided into sections and thicknesses as follows:

1141 ft., $\frac{6}{32}$ in. 170 ft., $\frac{7}{32}$ in. 160 ft., $\frac{8}{32}$ in. 680 ft., $\frac{10}{32}$ in. 320 ft., $\frac{12}{32}$ in. 540 ft., $\frac{14}{32}$ in. 100 ft., $\frac{16}{32}$ in.

Suitable valves for relief, in case of water hammer, are provided, the pipe being covered with 18 inches of earth, and provided with massive concrete anchors at proper intervals along its length.

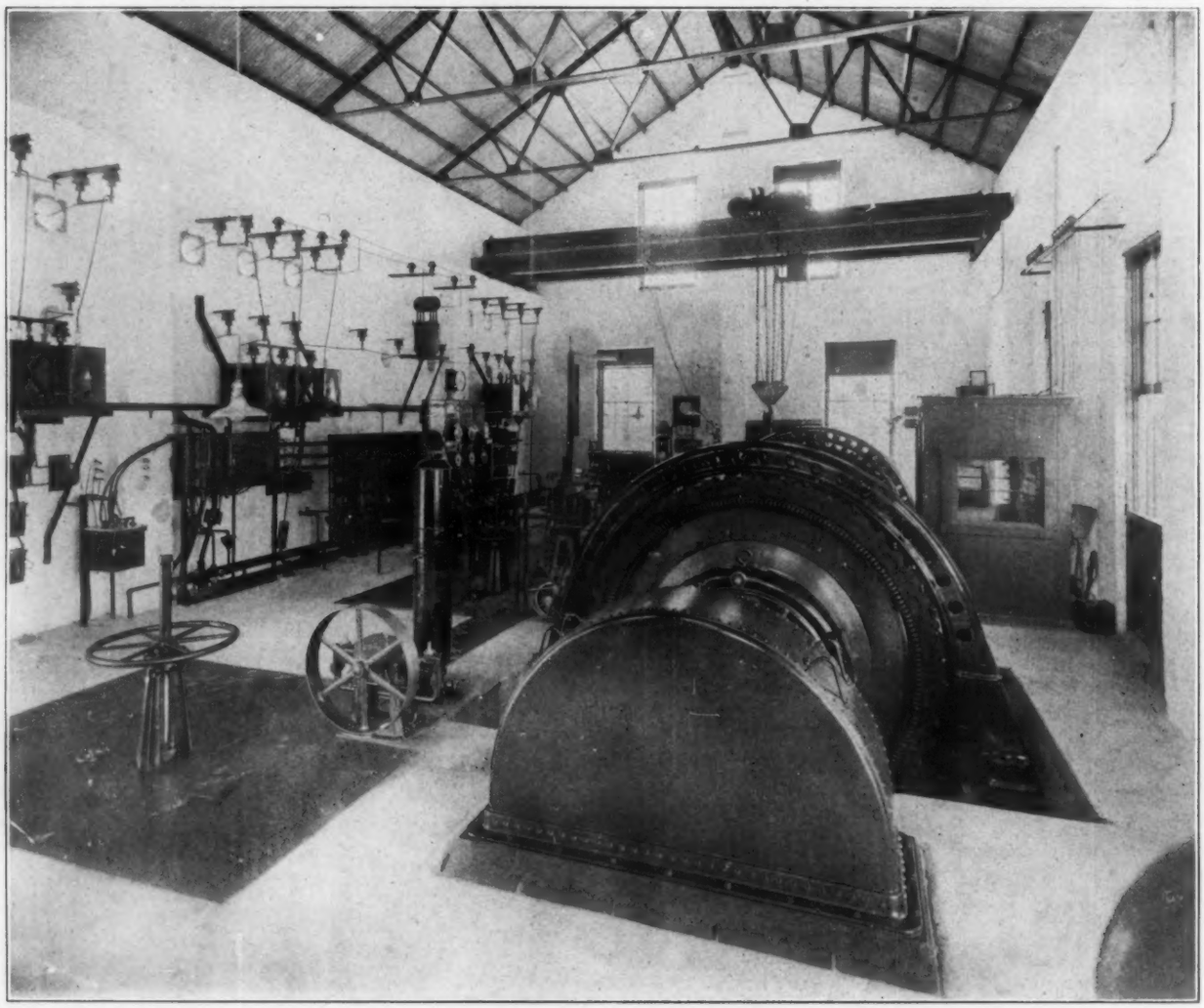


Fig. 8 Interior of No. 3 Power House

Power House No. 3

Without the introduction of a receiver, the water issues from the four 6-inch needle-regulating deflecting nozzles to impulse wheels, two of which are connected to each of the two 1,000-kw., 550-volt, 300 r. p. m., 60-cycle, 3-phase Bullock alternators, which feed solidly into the transmission line without protective devices, through non-automatic oil switches and disconnecting line switches. The generators are Y wound, the neutral being grounded.

The transformers, each in a separate concrete cell, are placed in a concrete addition to the main building, also of concrete, with steel-trussed roof, as seen in Fig. 9, behind the iron-plate doors. Gauges enter the generator room, showing the height of oil and indicating any leaks in the water-cooling system. A flooding system, admitting water under high pressure

Fig. 9 Exterior of No. 3 Power House. Fire Proof Transformer and Lightning Arrester Cells in Lean-to

to the bottoms of each transformer case, is provided in case any transformer should give serious trouble. Leakage from this system into the case under normal conditions is prevented by using two gates into each transformer flooding tap, a tiny hole to indicate leakage in the first gate being provided in the bottom of the pipe between the two gates.

Fig. 10a No. 1 Intake at Junction of North Fork and South Fork of the North Fork

One of the cells contains the lightning arresters, which are of the General Electric zigzag, non-arcing, metal type, with series carbon resistances. These arresters are used throughout the system, one of the three slabs of which may be seen in the photo of Fig. 27. They have taken care of lightning discharges in a most perfect manner. It is worthy of note that these arresters are after all very little different from those in use twelve years ago, the introduction of a series carbon resistance being the only change of note.

From the tail race of power house No. 3 the water is at present discharged into the river bed of the North Fork, whence it flows to the simple intake of No. 1 at the junction of the North Fork and the South Fork of the North Fork. (The San Joaquin River has an enviable reputation for "forks.")

Intake and Conduit No. 2 and No. 1

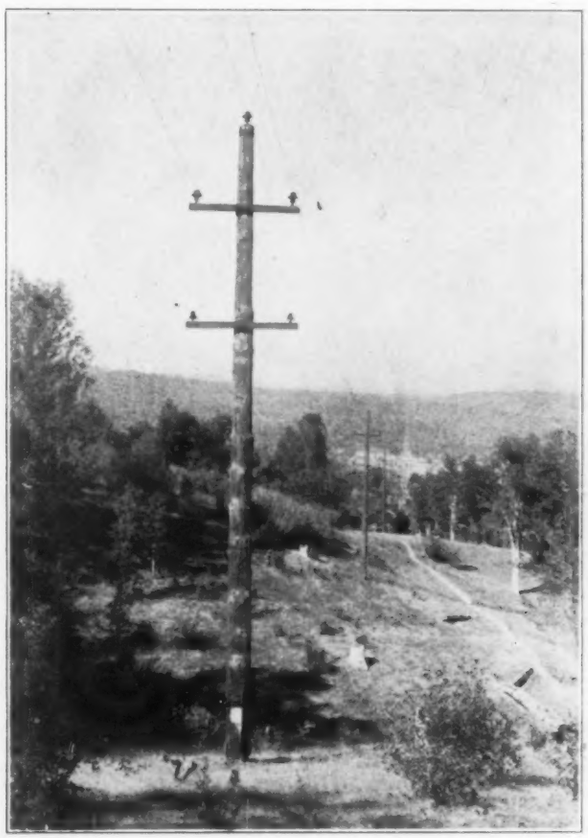


Fig. 10 Looking North on Line Between No. 1 and No. 3 Power Houses, Showing Combination Pine-Cedar Stubbed Pole

At present a fall of 350 feet is running to waste in this river channel, but it is eventually planned to construct No. 2 system in this gap between the two present plants, as may be seen on Map II.

Nature was kind to "No. 1." She provided a place in the North Fork where the waters could be diverted with little cost; she provided an easy country through which a dirt ditch could be cheaply constructed, capable of carrying 75 second-feet, with a fall of 5.28 feet to the mile for seven miles; she provided a most charming ridge at the end of the line for a couple of miles of quite the right height and in a most opportune situation, ending in a sheer promontory especially designed by her for a pressure pipe. She even went so far as to provide a basin at the top of this declivity, so that at a cost of less than $3,000 an embankment 8 to 10 feet in height and 500 feet long was constructed to enclose a patch of

about 8 acres, forming an ideal regulating forebay reservoir, conserving constantly a four days' supply to No. 1. There is just enough land left to contain the residence of the superintendent of the ditch system, who has lived on this upper crest since the plant was constructed, through twelve years of faithful service.

From the entrance of the ditch into the reservoir a ditch is shunted around the brow of the promontory, ending in an intake box in the pipe line to serve No. 1 in case of accident to the reservoir.

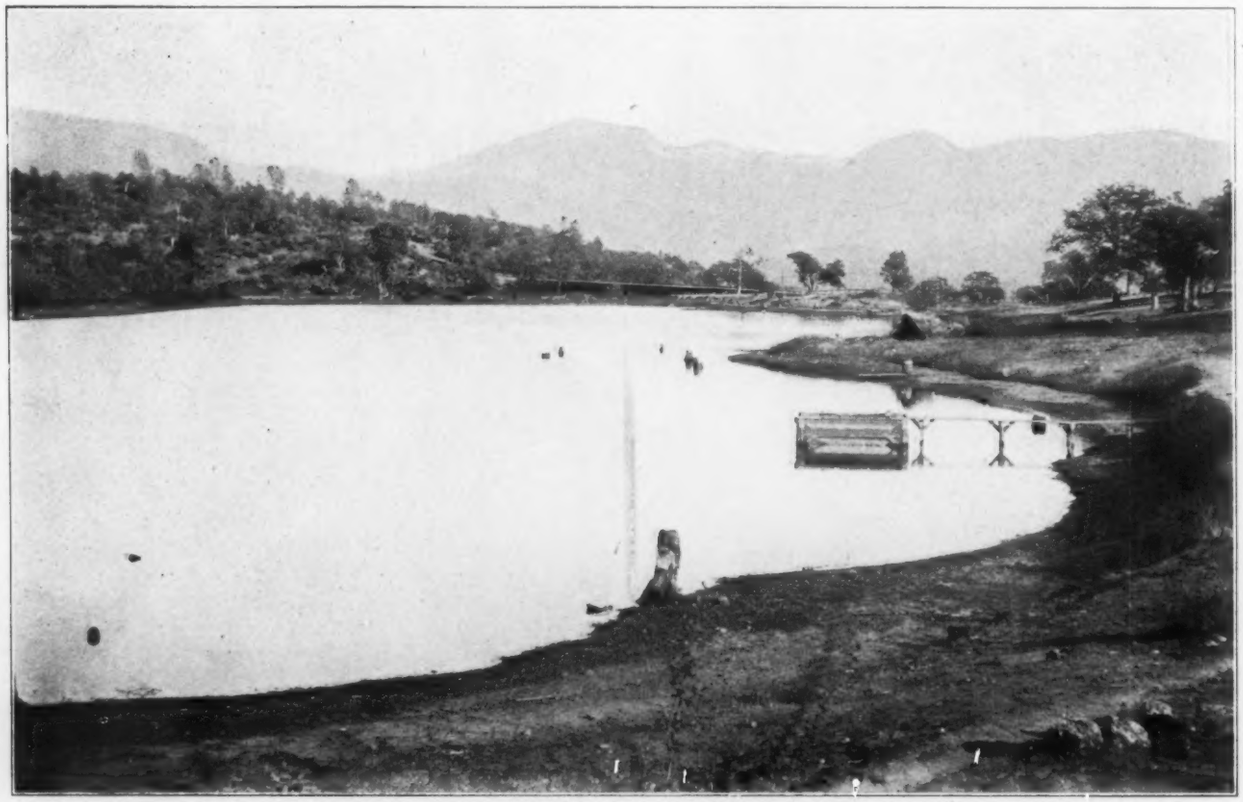


Fig. 11 Regulating Forebay Reservoir for No. 1

The pipe line down the rocky declivity to No. 1, 1,411 feet below, is 4,077 feet in length, consisting of four sections. The first, 960 feet in length, is of No. 12 b. w. g. riveted steel 24 inches in diameter. Following is 860 feet of 24-inch pipe of ¼-inch riveted steel. Standard Converse lock-joint welded pipe 20 inches in diameter, with expansion joints, is used for the next 400-foot section, followed by 1,800 feet of 5/8x20-inch lap welded pipe with flanged joints. The whole is terminated with a 30-inch receiver 57 feet in length, constructed of ¾-inch butt strap riveted steel with ¾-inch rivets. The pipe is buried various depths, with the exception of the expansion joints, which require inspection, especially at the first real approaches of winter and summer. The pipe is anchored to the solid granite by means of 2½x5/8-inch U bands, with split rods sulphured into the bedrock, besides many cement-collared anchors. The line has well withstood the twelve years of service with no trouble of importance, although a very early example of the solution of a then new problem.

No. 1 Pressure Pipe Line

The No. 1 plant is of cardinal historic interest, as when it was put in operation in 1896 many anxious engineers heard with trepidation the fierce, harsh roar when the water was turned on the first wheel, at 609 pounds pressure, at that time the highest head in the world.

Power House No. 1

The needle regulating nozzle was not in use at that time. The deflection regulating 1⅛-inch nozzle, installed in the plant originally, may be seen in the scrap heap at the back of the power house.

One who may be fortunate enough to possess the early issues of the "Journal" finds much pleasure and profit in reviewing the April number of 1896, where early experiences with this plant are interestingly told.

Of the original power-house equipment, the generators only remain as then installed, there having been added to the three 350-kw., 60-cycle, 700-volt, 600 r. p. m. General Electric generators a similar 360-kw. machine of a more recent make.

The old air-ventilated transformers have been replaced by six 200 kw. General Electric air-blast transformers, cold air being taken from the tail-race tunnel for the blast, as in this locality, in the bottom of a canyon so crooked that wind has some difficulty in blowing through it, the summer days are excessively hot.

Latterly four 200-kilowatt, oil-filled, water-cooled transformers have been installed, forming a 3-phase set with one reserve, which can be used with any of the other sets, and stands "hot" in readiness for such service. Type F, Lombard-Replogle mechanical governor and a Tirril regulator serve to keep variations of speed and voltage to a minimum.

In the rear of the view of Fig. 14 may be seen the line from No. 3 entering the station in the left corner and the two duplicate lines leaving for the valley, through the rear wall. Kellman oil-break switches and a double set of busses serve to switch these three circuits into any desired combination. It is noticeable that the generators are not provided with fuses or circuit breakers, the generators being connected solidly into the line.

operation of the lines could be noticed.

From this plant a 30,000-volt line of three No. 0 wires extends 7½ miles to the original No. 1 power house, the construction of which is interesting in that home products, with the exception of Mexicans for ground men, were used in its construction. The pine poles were supplied in the immediate vicinity. No attempt was made to put these poles in the ground, on account of their quick decaying qualities. Stubs 10 inches square and 10 feet long were sawn from the heart of fall-cut cedar, which grow in lesser numbers in the neighborhood. To these stubs, by means of two ¾-inch U bolts and armature, the pine holes were bound, as may be seen in the photo of Fig. 10. Three years of service have developed no trouble. This line enters the old original power house No. 1

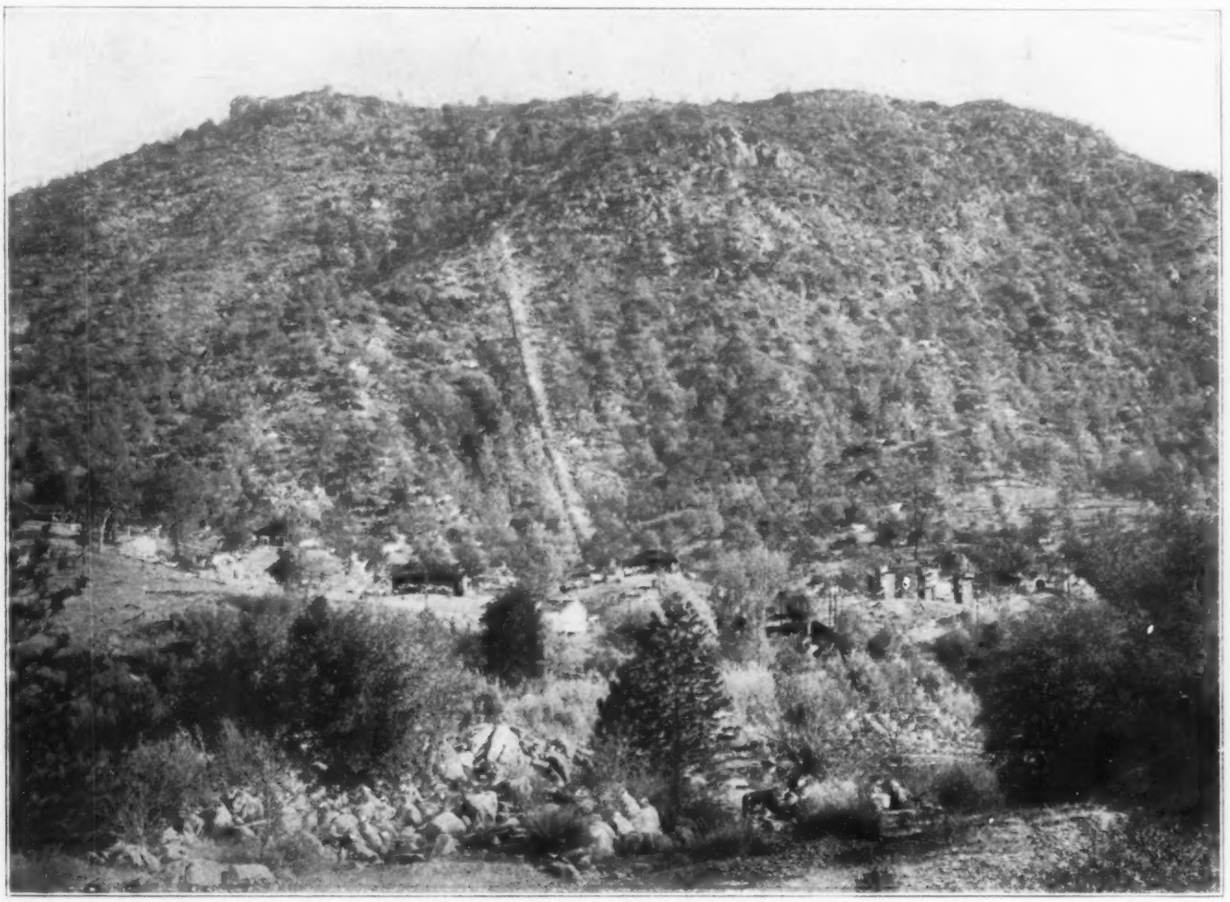


Fig. 12 Pipe Line and Camp No. 1 Power House

The exterior station view of Fig. 9 shows the transformer rooms of No. 3, the farthermost source of power on the system and the location of an instructive accidental test of the insulating qualities of snow. Above the transformer sheds shown at the left, with iron-bound doors, the 30,000-volt lines leave for plant No. 1 and the valley. At one time these wires and insulators were entirely covered with an unusually heavy fall of snow on the roof, some three feet in depth, while no effect on the

Transmission Lines

through an oil switch to a double set of busses, shown in the extreme end of the building of Fig. 14. Connecting with these busses also are the leads from the step-up transformers of No. 1, so that the current from No. 3, as well as that coming from within No. 1, may each be switched to either of the duplicate lines down the valley.

Referring to the map, it will be seen that from this power house extend southward two transmission lines for the greater part on the same right of way, as viewed in Fig. 16, to a point where the fertile

level floor of the valley meets the rocky foothills—the first stepping stones to the high Sierras. Once the source of wondrous wealth in the placer sands of the interlaced washes, these foothills give little evidence of the exciting days of '49.

At present a lonely copper mine is the sole mineralogical survivor of the particular locality. The mine derives its power from transformers in a small sub-station near the switching station of Figure 17.

The switching station, located at the beginning of the distribution of power, is an important engineering feature—a nervous center, as it were—of the system. For here the duplicate lines from No. 3 and No. 1, the line skirting the valley to Madera, and

The poles between No. 1 and Fresno are cedar, as may be seen in the east line of Figure 16. This also shows the west line, which was transformed from a 2-circuit line of No. 3 wire, as shown in Figure 20, to a single circuit by twisting the wires together to form a 2-strand cable. This line has required little stubbing, thus showing the superiority of square redwood poles when properly selected.

Long span work has been used, with success, under the mild climatic conditions of this section.

Between Clovis and Fresno, every other pole of the original line has been removed, making the spans 240 feet, while the line to Madera from the Clovis

Fig. 13 Exterior Present No. 1 Power House, Showing Incoming No. 3 Line on the Right, Choke Coils on Poles and Lightning Arrester Sheds on the Left

those over the floor to Fresno, Corcoran, and Cottonwood Creek, may be switched each to the other in various permutation.

The six circuits mentioned above, including the copper mine sub-station, enter the gable of the concrete structure, 18 wires in all. Each circuit is connected both to the bus on the north side and the bus on the south side of the concrete building, by means of disconnecting switches and oil switches. By this means any circuit may at any time be connected to any other in a thoroughly flexible manner.

Reference to the map and to Figures 10, 16, 24, 25, and 33 will give a very comprehensive idea of the transmission lines.

switching station is composed of 250-foot spans. The line from Fresno to Kerman of No. 6 wire has its spans 350 feet in length for 12 miles and 250 feet long for the five miles nearest Kerman. For many small branches off the 4,000 and 6,600 volt lines, iron wire with 500-foot spans is common.

Fresno Substation and Steam Reserve

In the formidable array of wires in Figure 21 we see the 30,000-volt lines entering the Fresno substation and the 30,000-volt feeders leaving the building for Kerman and down the valley through Hanford. The city 2,000-volt distributing-system wires are also shown, while the 250,000-gallon tank mentioned in connection with the Fresno

water system, under other pages, is seen in the extreme right field.

Underneath the tile behind the iron doors, in individual compartments, separated by a concrete wall from the interior of the sub-station, are located the nine oil-filled, water-cooled transformers for supplying Fresno with power. Three 200-kilowatt General Electric 30,000 to 2,300 volt transformers convert to a 3-phase, 4-wire system of 4,000 volts or 2,300 volts, being thus connected in Y on both sides. Six 500-kilowatt transformers, two being of Stanley make and four of Bullock manufacture, transform from 3-phase of 30,000 volts to the 3-phase, quarter-phase system shown in Figure 23, which will shortly be described. Two banks of lightning arresters of the type seen in Figure 27 are also enclosed in this compartment. Above these transformers and lightning arresters is the 30,000-volt oil-switch and bus-bar gallery within the station proper, seen in the background of Figure 22. A double set of bus-bars renders this an oil-switching station similar to the one at Clovis, but of less complication. Within the station one finds the feature most worthy of note,—a double set of synchronous motor generators for supplying the Fresno Traction Company with direct current.

One 300-kilowatt General Electric and one 200-kilowatt Westinghouse synchronous motor generator set performed this function, being so connected through a positive clutch on either end of a pulley that they may be operated by a 750-horsepower McIntosh & Seymour cross-compound condensing engine in case of trouble or shortage of power. In such an instance the synchronous motor sets are used as 3-phase generators as well as the d. c. generators. The output in such case at full load might reach 1,000 kilowatts, which is sufficient excuse for the exceedingly large belt seen in the foreground of the interior view of the station. The six-foot belt shown in Figure 22 stands constantly ready for this obscured by a belt tightener, in itself an instrument of quite formidable design.

We find also a 600-horsepower Union Iron Works compound, non-condensing engine, belted to two 180-kilowatt, 2,300-volt, quarter-phase Westinghouse generators for reserve purposes on the quarter-phase city circuits.

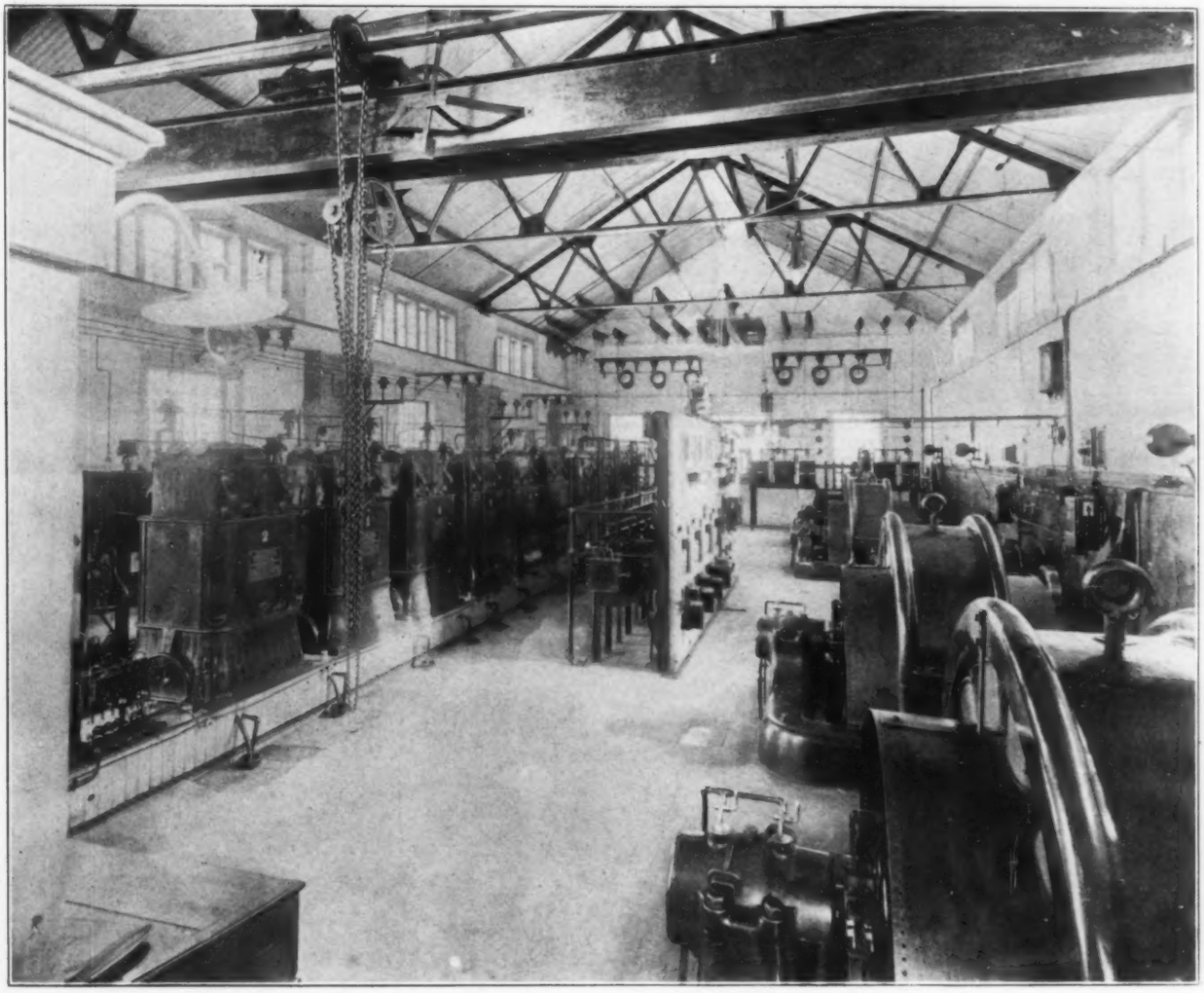
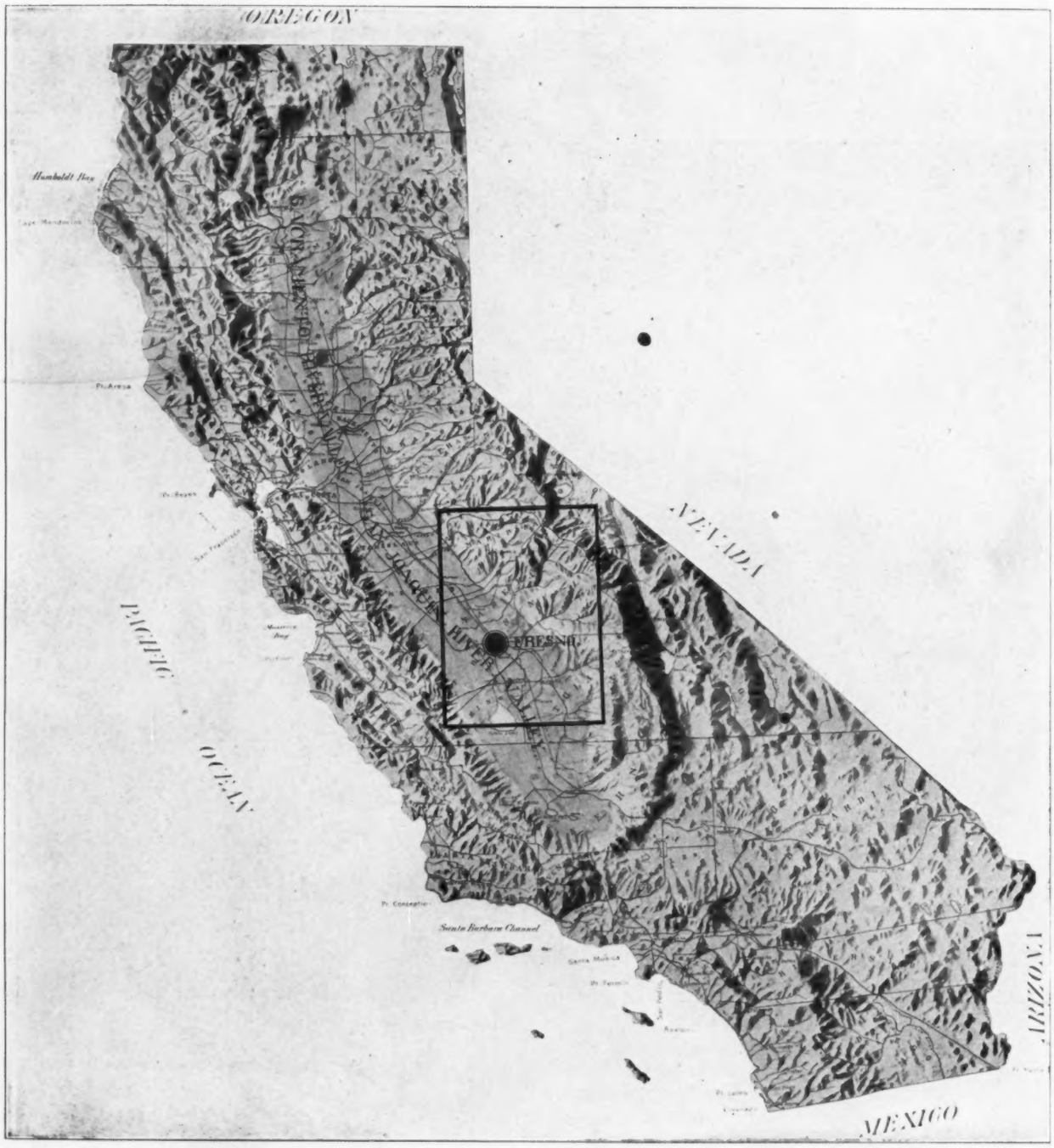


Fig. 14 The New No. 1 Generators Only Remain of the '96 Equipment



Courtesy California State Mining Bureau

I. Relief Map of the State of California

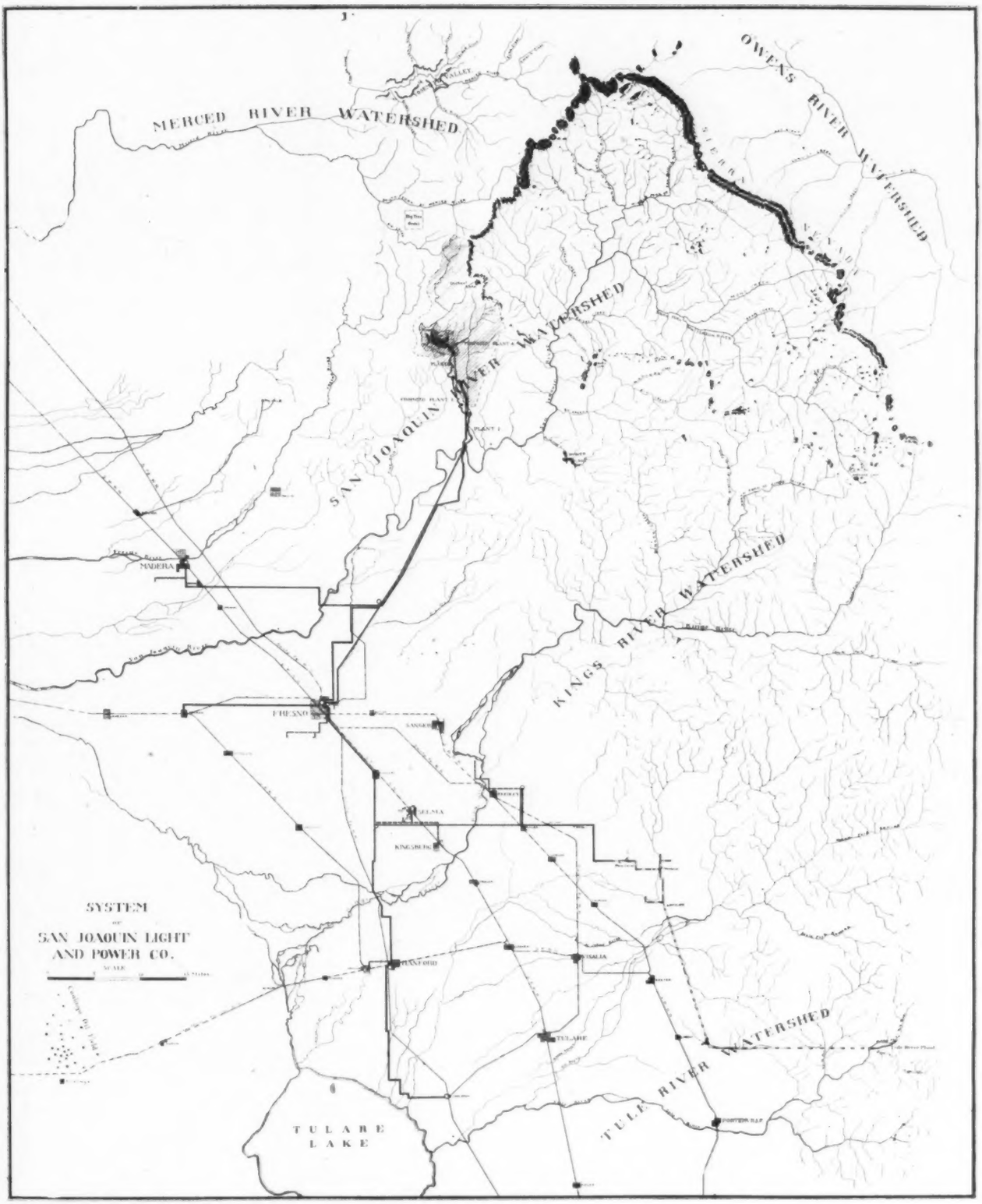

MERCED RIVER WATERSHED
OWENS RIVER WATERSHED
SAN JOAQUIN RIVER WATERSHED
KINGS RIVER WATERSHED
TULE RIVER WATERSHED
MADERA
FRESNO
SANGER
REEDLEY
KINGSBURG
HANFORD
VISALIA
TULARE
PORTERVILLE
TULARE LAKE
SYSTEM
OF
SAN JOAQUIN LIGHT
AND POWER CO.
SCALE

Fig. 15 The San Joaquin at No. 1 Power House

Fig. 16 West and East Mines, No. 1 to Fresno, 34.4 Miles, Tap-in Telephone Station on old (West) Line of 1896

Steam is constantly in one of the boiler batteries, composed of two 500-horsepower and two 350-horsepower Babcock and Wilcox boilers, in case of trouble.

Other Substations

In the views of Figures 26 and 27 we find a representative of the smaller sub-stations outside of Fresno, which contain oil-filled, air-cooled, 30,000-volt transformers, lightning arresters, oil switches, and integrating wattmeters. This particular station supplies the towns of Selma, Fowler, and Kingsburg, containing three 100-kilowatt, 17,300 to 2,200 volt Wagner transformers, connected YY, for a 4-wire, 3-phase secondary system. A duplicate of this equipment is to be found in the Madera, Corcoran, and Reedley, while at Stone Corral the same capacity is installed in 17,300 Y to 6,600 delta.

At Hanford, three 133-kilowatt transformers of a similar type convert to a delta distribution at 2,300

Fig. 18 Interior Clovis Switching Station

volts, supplying Hanford and Armona, while 50 and 75 kilowatt transformers are located in the sub-station of Laton and Kerman.

The sub-station at Copper Mine is of a different type, containing air-blast transformers connected in Y on the primary and in delta to give 500 volts for motor work on the secondary.

Fig. 17 Clovis Switching Station and Lines to Fresno

Distribution to light and power in the city of Fresno is effected at 2,000 volts, stepping down by means of standard transformers for lighting at 100 and 200 volts and to motors of 200 and 400 volts.

Distributing Systems

Circumstances obtaining from time to time during several years past have caused the introduction of both three and quarter phase motors in the city of Fresno. The resulting complication has been solved by the company in the simple manner diagrammed in Figure 23. The company specifies that 400 volts should be used in motor installations of 50 or more horsepower, in which case separate but standard 2,000 to 400 volt transformers are used in a fashion similar to the above diagram. Recent and present practice is confined to the installation of 3-phase motors wherever possible. Westinghouse 2,000-volt lightning transformers are used throughout, with General Electric primary cut-outs.

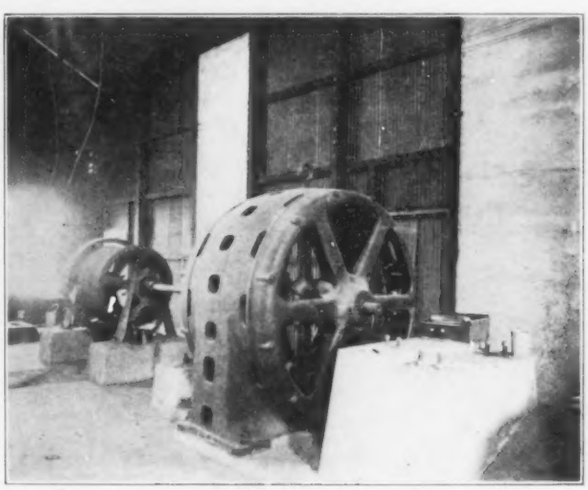


Fig. 19 500 H. P. Westinghouse 3 Phase Motor at Copper Mine Near Clovis

Distribution in towns or districts outside of Fresno is effected by the employment of 4,000 and 6,600 volts.

Fig. 20 The Old '96, 11,000 Volt Double Line Vanishing Toward Fresno

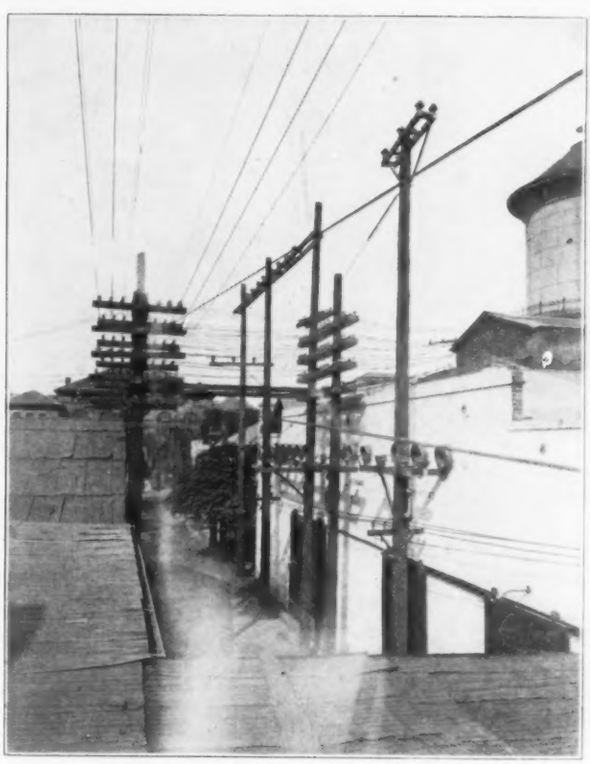


Figure 21 Two, 30,000 Volt Line for No. 3 and No. 1 Entering Fresno Sub. Two, 30,000 Volt Lines Leaving Fresno Sub. for Kerman and Hanford. Behind Iron Doors are the Fire Proof Transformers and Lightning Arrester Cells

For the towns of Madera, Fowler, Selma, Kingsburg, Reedley, Dinuba, and Corcoran, and environs, the 4-wire star-connected, 4,000-volt system for primary distribution to lights and motors is employed; so that single standard 2,000-volt transformers may be connected for lighting between the neutral and either of the three main wires, while three transformers in star are used for motor installations and short transmission work.

In the city of Hanford and in Kerman, Laton, and Armona, a 2,300-volt, 3-wire primary system is maintained.

to grapes, peaches, pears, prunes, plums, and a very extensive nursery stock. Although there were no 30,000-volt lines in the beautiful cajon of the Stone Corral Valley, it was here that the world-famed bandits, Evans and Sontag, received a paralyzing shock. We see the highest peak of the ragged edge of the valley, where they maintained their look-out previous to their capture. The Stone Corral is now developing as a fruitful power sink, with its many hundreds of acres of newly planted citrus land.

At the end of the 6,600-volt line in Cottonwood Creek there is also great activity in newly established

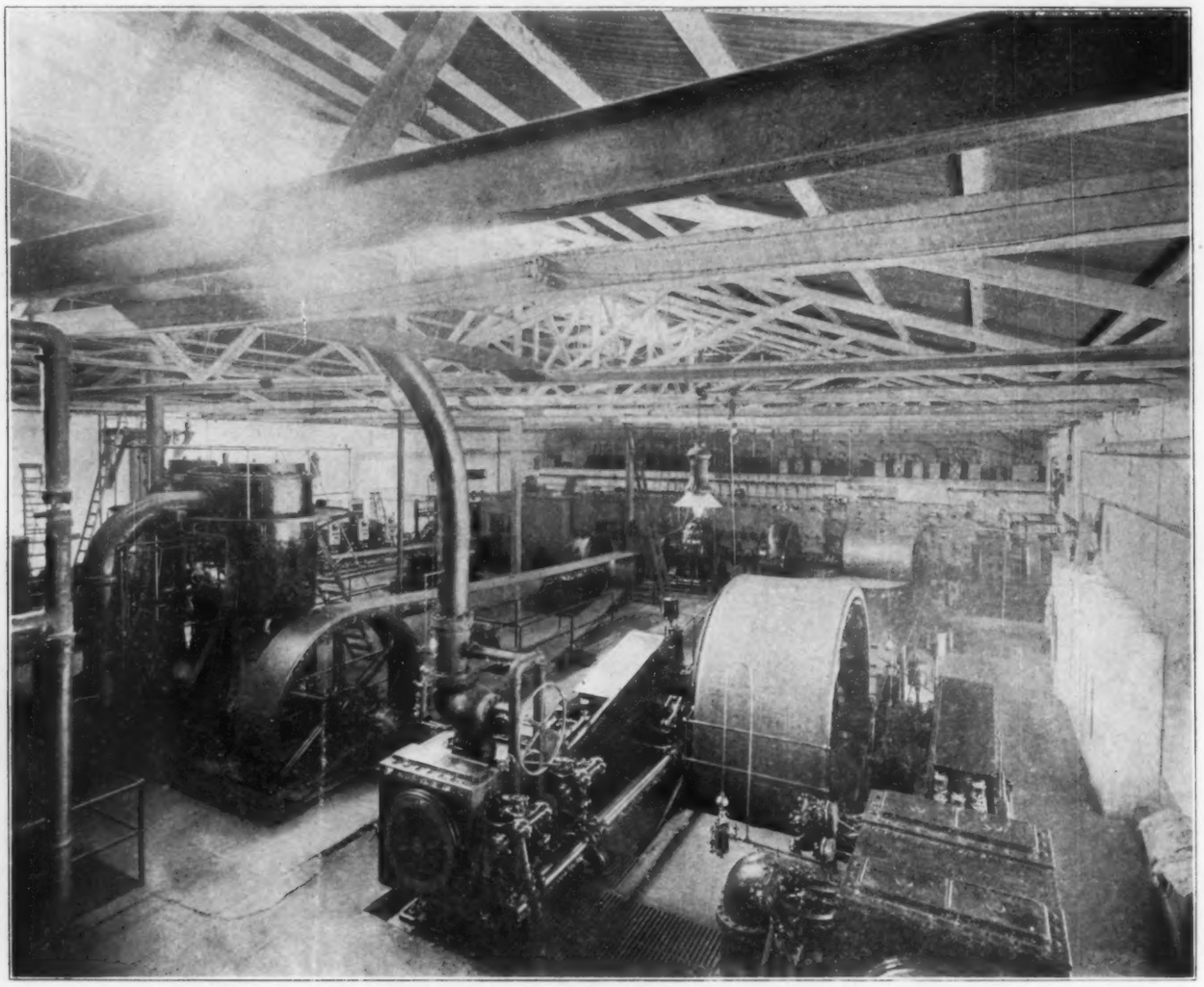


Fig. 22 Fresno Substation

6,600-volt transformers are used in secondary delta on line extending from the Stone Corral substation over a new and fertile citrus district. This system includes 18 miles of line having small No. 9 iron wire branches with 500-foot spans. The main lines of this particular system are of No. 6 copper, with 350-foot spans, and no. telephone wires. At the farthermost point, 10 miles as a wireless line would run, from Visalia the current is transformed to 200 volts for the use of a 40-horsepower motor, which supplies water for the beautiful ranch of the Redbanks Orchard Company, containing 700 acres planted citrus farms. This 6,600-volt system from Stone Corral to Cottonwood is now delta connected. Eventually it will be changed to a 10,000-volt Y-connected system, in common with many branches which are now 4,000, tending toward a universal secondary-power voltage of 10,000.

The fuse employed on the 6,600-volt circuits is a shellacked stick of maple 12 inches long between clips, something after the fashion of an enclosed fuse, but diamond shaped in cross section. Wrapped around it are the protective

fuse. New ones are being constructed with an insulator at the middle point, into which a threaded stick may be inserted for switching or renewing.

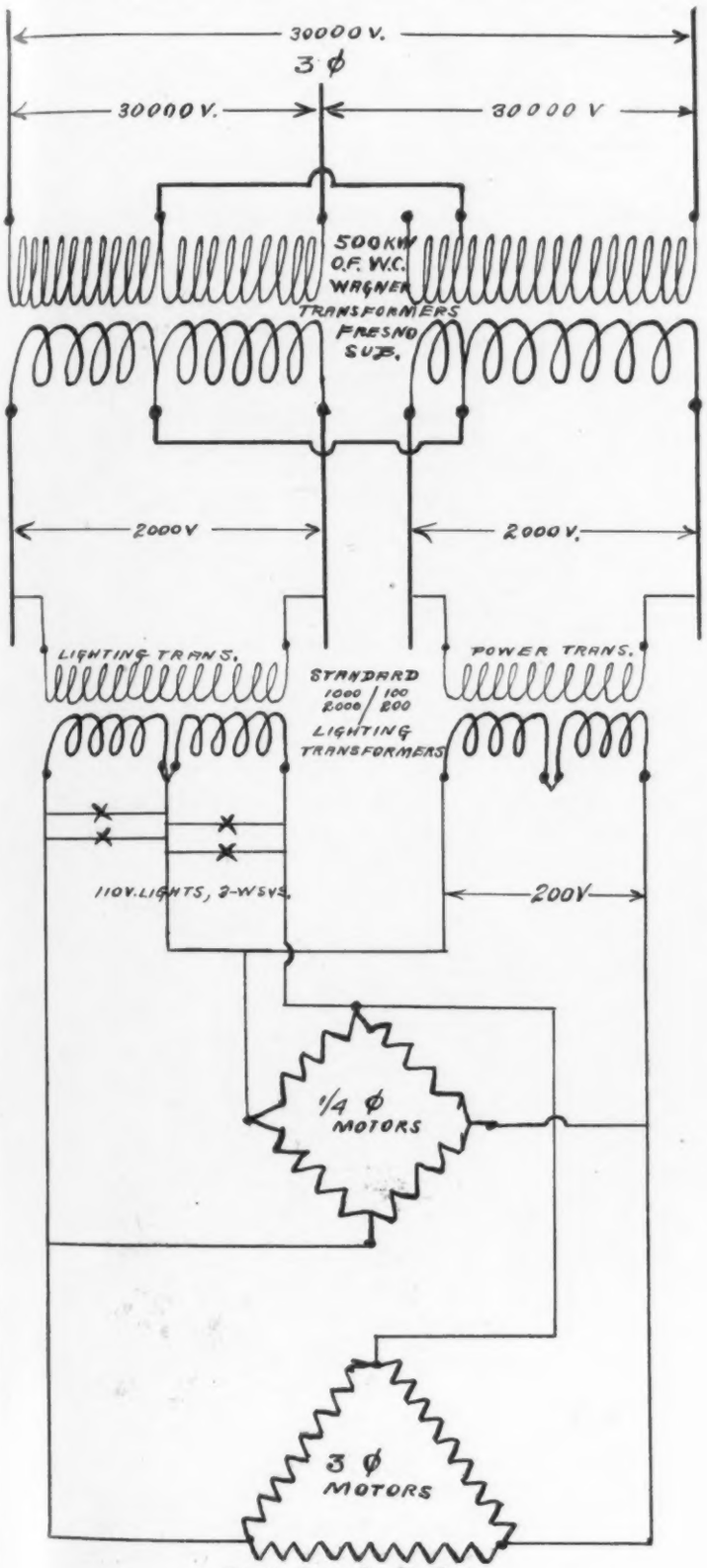


Fig. 23 Fresno City Distribution

On the 400-volt primaries the General Electric fused primary cut-outs are used throughout the company's properties.

Telephone System

Communication between the two hydraulic plants and the various sub-stations—from the sugar-beet fields at Corcoran, around Lake Tulare, through Fresno, to the pine-rimmed camp at the Crane Valley Reservoir, a hundred miles distant—is exceptionally safe and satisfactory; the noisome inductive humming usually present in connection with long-distance transmission systems being quite thoroughly eliminated.

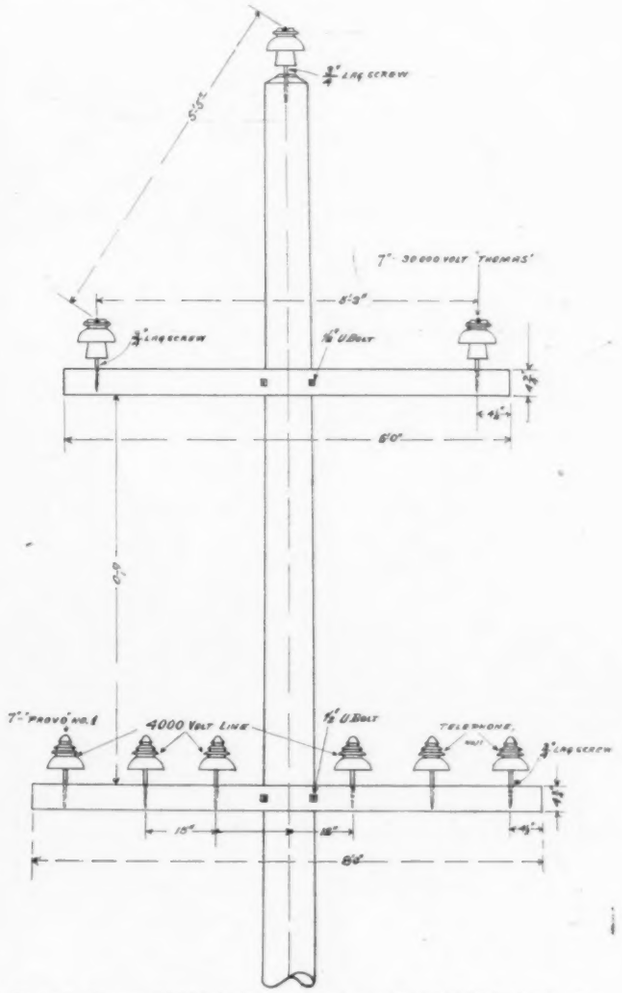


Fig. 24 Recent 30,000 Volt Construction with 4,000 Volt 4-Wire System and Telephone System Below

The diagram of Figure 30 illustrates the manner of obtaining these results, by the use of a small standard transformer whose primary windings are placed in series as on a 2,000-volt system, the connection between them being grounded, while the secondary of the transformer is left open. Magnetic and static induced electro-motive forces, which in some systems reach very high values, are here entirely absent, the currents being continuously discharged to ground through this "repeating coil" of high resistance, with no effect upon telephonic communication. This method is also in use on the Kern River line to Los Angeles, where the normal inductive voltage on the line was reduced from 2,000 to 28 volts to ground by the introduction of transformers.

The discharge due to lightning, or by virtue of a cross with the 30,000-volt line, arcs to ground between two 3-inch carbon biscuits 5/8-inch in thickness and through a hole an inch and a half in diameter in a 1/32-inch sheet of mica placed between them, thus blowing the fuses and protecting the operator and the phone. The carbon biscuits are set to discharge at 500 volts alternating current, which adjustment they permanently and accurately maintain.

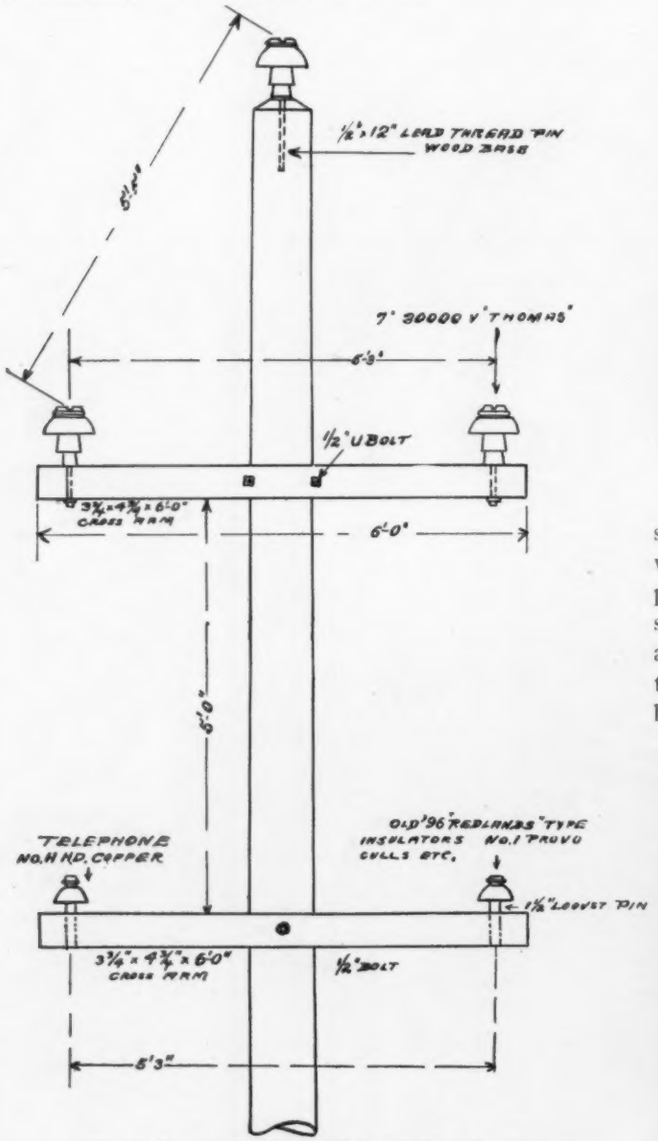

1/2" x 12" LEAD THREAD PIN WOOD BASE
7' 30000 V "THOMAS"
5'3"
1/2" U BOLT
3 3/4" x 4 3/4" x 6'0" CROSS ARM
6'0"
6'0"
TELEPHONE NO. 4 HD. COPPER
OLD '96 "REDLANDS" TYPE INSULATORS NO. 1 PROVO CULLS ETC.
1 1/2" LOCUST PIN
3 3/4" x 4 3/4" x 6'0" CROSS ARM
1/2" BOLT
5'3"

Fig. 25 Construction 3 Years Old from No. 3 Power House to Fresno 41 Miles

Since the introduction of these devices, three years ago, no one has received injury, nor has a phone been disabled by such usual sources of trouble, with the exception of one instrument which was not so protected when a cross occurred between the telephone and the 30,000-volt line—a very convincing proof of the effectiveness of the method.

The new telephone line wires are of No. 11 B. & S. copper, while the old original wires are of No. 14. They are placed 5 feet below the lower 30,000-volt wires and on a cross-arm 5 feet 3 inches apart. The insulators consist of high-voltage "culls" and the old "Redlands Type" porcelain ones used originally on the 11,000-volt line of '96. (Figure 20.)

From Fresno to power house No. 1 there is a telephone line on each transmission line, as shown in the views of Figure 16, one of No. 11 and the other of No. 14.

Fig. 26 Selma—Kingsburg Substation

Phones are located at all stations and substations and in the residences of local superintendents, where insulated platforms are further provided for the protection of the operator. The line patrolman finds suitable tap-in boxes for use of the "portable" located at convenient points, one of which will be seen on the west line of Figure 16, with its insulated step below.

Fig. 27 Selma Substation

It will be recalled that the transmission lines, whether of 30,000, 6,600, or 4,000 volts, are entirely free from transpositions. The telephone line, however, is transposed at 10-pole intervals. Where the poles are 240 feet apart, as on the lines between Fresno and the Copper Mine station, the distance of 2,400 feet between transpositions is much greater than is usual.

We thus find here another example of the tendency toward combined simplicity and reliability, so neatly illustrated throughout the properties of the company.

Fig. 28 Selma Pumping Plant, of Ice, Storeroom, Shops, Etc.

The power company also furnishes power to operate the domestic water supply systems of Madera, Selma, and Fresno.

Water Systems

In the former town, of some 2,000 inhabitants, the system of nine miles of water mains and lateral ramifications has its source in a simple although reliable and efficient pumping plant at the edge of town, while the two water tanks are some

Fig. 29 Selma Gas Works and Young Eucalyptus Grove

distance away in a more central location. In the small, neat brick station, which is half aboveground and half a water-tight pit below the surface, shown to the right in the photo of Figure 31, is a most interesting pumping plant. It consists of two similar Krogh horizontal centrifugal pumps, each direct connected to 3-phase motors, the diagram of the pump connections being shown in Figure 32.

Under normal circumstances either pump may be operated at 45 pounds pressure, or thereabouts, the tanks up town floating on the system with the pumps in continual operation. By opening the gate "*a*" the dormant pump may be started up in case of fire, thus

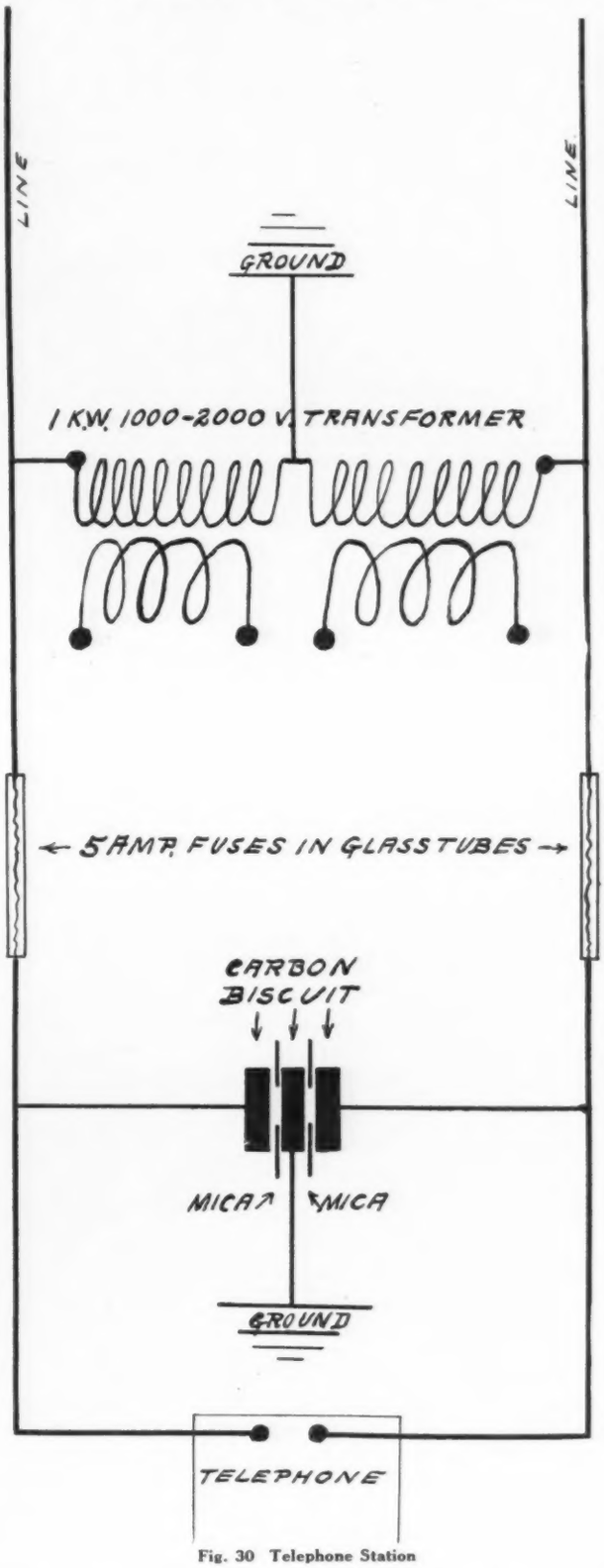


Fig. 30 Telephone Station

putting the two in series to produce a pressure of 90 or more pounds. As a result of this arrangement, no fire engines are used in either Madera or Selma.

The motors are equipped with Westinghouse no-voltage and overload oil-break circuit breakers, and controller type auto-starters.

Thus with the automatic nature of the centrifugal pump at constant speed, furnishing widely various quantities of water at a very constant pressure, at the invariable speed of the motors, the station is well equipped to run cheerfully alone day in and day out, with that perfect understanding which exists betwixt an induction motor and a direct-connected centrifugal pump, although rivals in effectiveness and reliability.

Fig. 31 Madera Substation and City Pumping Plant

The arrangement at the Selma plant is almost identical with the one at Madera, and alike in the satisfaction which it gives. The Selma system threads the town with 9½ miles of piping, supplying a population of 2,500.

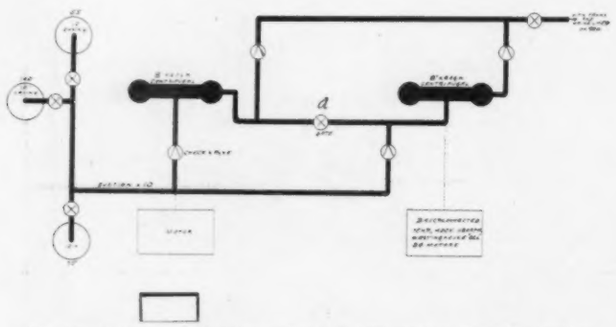


Fig. 32 Diagram of Madera and Selma City Water Pumping Station

The water system of Fresno contains similarly interesting features. The 47 miles of system are supplied by six pumping plants at widely separated points, each containing a direct-connected centrifugal pump, one or more of these pumps floating in parallel on the system containing one 250,000-gallon tank. This supplies, through practically a ring system, a large volume of water from several different directions to a fire engine at any particular point with a system of interconnected mains, maintaining a constant pressure practically automatically with varying demands. Analogous to electrical phraseology, this is purely a parallel system, since engines are used for fire protection, as distinguished from the series system of pump connections in Madera and Selma.

A short distance from the water plant for the town of Selma, the power company also operates a gas plant, which is seen in the view of Figure 14. Thirty thousand feet of crude-oil gas per day is being supplied to a system of seven miles of mains and laterals. Some 3,000 eucalyptus, of the

Gas System

Fig. 33 Stone Corral Substation Showing 6,000 Volt, Iron Wire, 500 foot Span Line Towards "Look-out Mountain," at the Left. Three, 100 K. W. 17,300 - 6,600 Volt Transformers

red gum variety, are being grown around the gas plant to partly absorb the odorous smells and waste waters and to obscure from sight the source of the same.

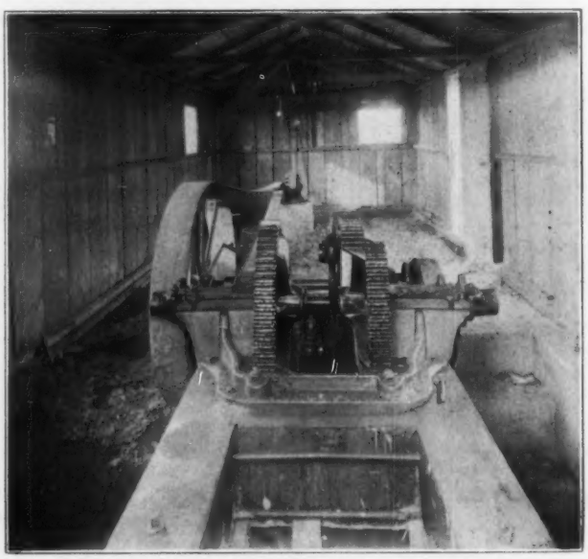


Fig. 34 Typical Orange Grove Pumping Plant "Stone Corral" off of 6600 V Line.

There are things for the economist to think about around Fresno, where thousands of acres of land are being newly cultivated and brought under artificial irrigation by means of pumping plants. Here we find at the copper mine, which has been already mentioned, the installation of a 500-horse-power induction motor, which is the largest on the

Power Sinks

system. In one planing mill in Fresno there is consumed 190 horsepower in the 15 motors it operates,

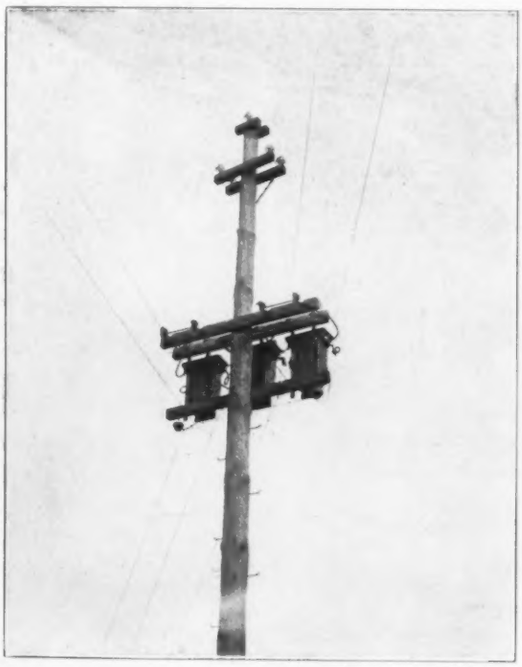


Fig. 35 6600 Volt Transformer Hanging for Orange Ranch Pumping Plant of the "Stone Corral"

while another mill in Fresno utilizes 225 horsepower in 18 units. The Dinuba mill subscribes for 40 horse-

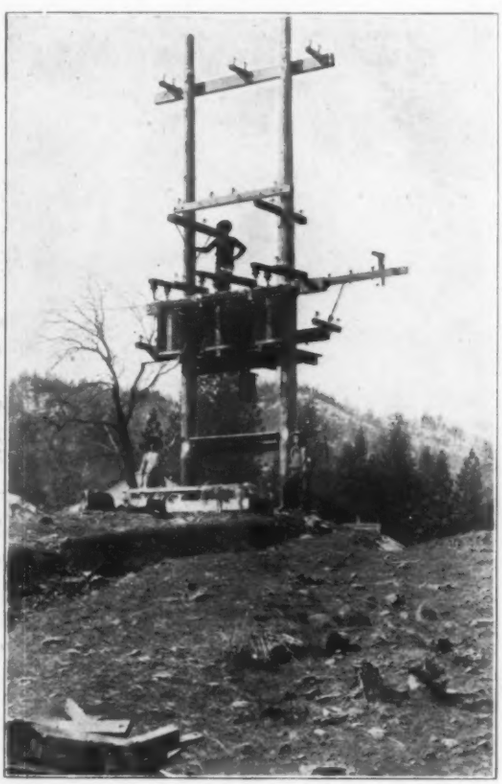


Fig. 36 6600 Volt Transformer Hanging at End of 600 Foot Span, for Construction of New Crane Valley Dam.

power, while a flour mill at Selma consumes 50 horsepower.

In Figure 37 is shown a 75-horsepower pumping plant off the 4,000 line from the Reedley sub-station, which lifts water from the Kings River for irrigation of 478 acres recently purchased by a colony from far-off Finland. The cost per acre for this irrigation is $1.65 annually, for a constant year-around supply. A 15-horsepower plant supplies 110 acres adjoining the other tract belonging to the same colony.

Fig. 37 Finlanders 78 HP. Pumping Plant for 478 Newly Tilled Acres

The Redbanks Orchard Company, having recently brought into bearing 700 acres of choice foothill land planted to all kinds of deciduous vines and trees, now uses a 40-horsepower motor for pumping. These are a few instances of a large number of plants similarly operated.

The Corcoran sugar plant has a 300-horsepower motor installed, while the Italian-Swiss Colony winery near Madera uses 100 horsepower, including a centrifugal plant for pumping wine.

Fig. 38 Farming of Today, Ploughing in the "Stone Corral"
Fig. 38 Farming of a Thousand Years Ago, Here the "Diggers" and the "Monos" Store the Acorns for Grinding Into Meal.

A local distributing company at Hanford consumes from 400 to 500 horsepower, which is used for lighting and power purposes, including the pumping of water for city use and the operation of the flour mill.

Hundreds of horsepower are used in the many packing houses for seeding raisins, sorting, packing, telpherage, etc.

The Fresno Water Company is one of the larger consumers, absorbing annually current to the amount of $35,000.

The Fresno Traction Company, another large customer, consumes about half the above amount at present. Rapid demands of the traveling public have made necessary many extensions, so that in a short time a 30-car system will consume about $50,000 yearly in electric power.

The energy is supplied by the 300 and 200 kilowatt synchronous motor generator sets in the Fresno sub-station, as was described under that caption.

Fig. 39 U. S. Government Reclamation Service Pumping Plant. 80 Acres in Foreground Reclaimed by "Leaching" Process from Alkali

Redbanks Orchard Co. Ranch and Nursery 700 Acres Planted, 500 Acres in Contemplation

These various users of power at the present time are 5,786 in number, which does not include the customers in Hanford and Armona nor the gas consumers in Selma.

Miles and Miles of Grapes Yielding $14,000,000 Annually

Prices for Power

In the city of Fresno we find established the low base rate of 9 cents per kilowatt-hour, from which reductions are made to as low as 5 cents for large users consuming current under favorable conditions. Throughout the rest of the system the base rate is 10 cents, ranging as low as 5 cents.

For power purposes the rate is universally between 1 1/3 to 5 cents per kilowatt-hour, thus fostering the largest and most reliable and lucrative custom.

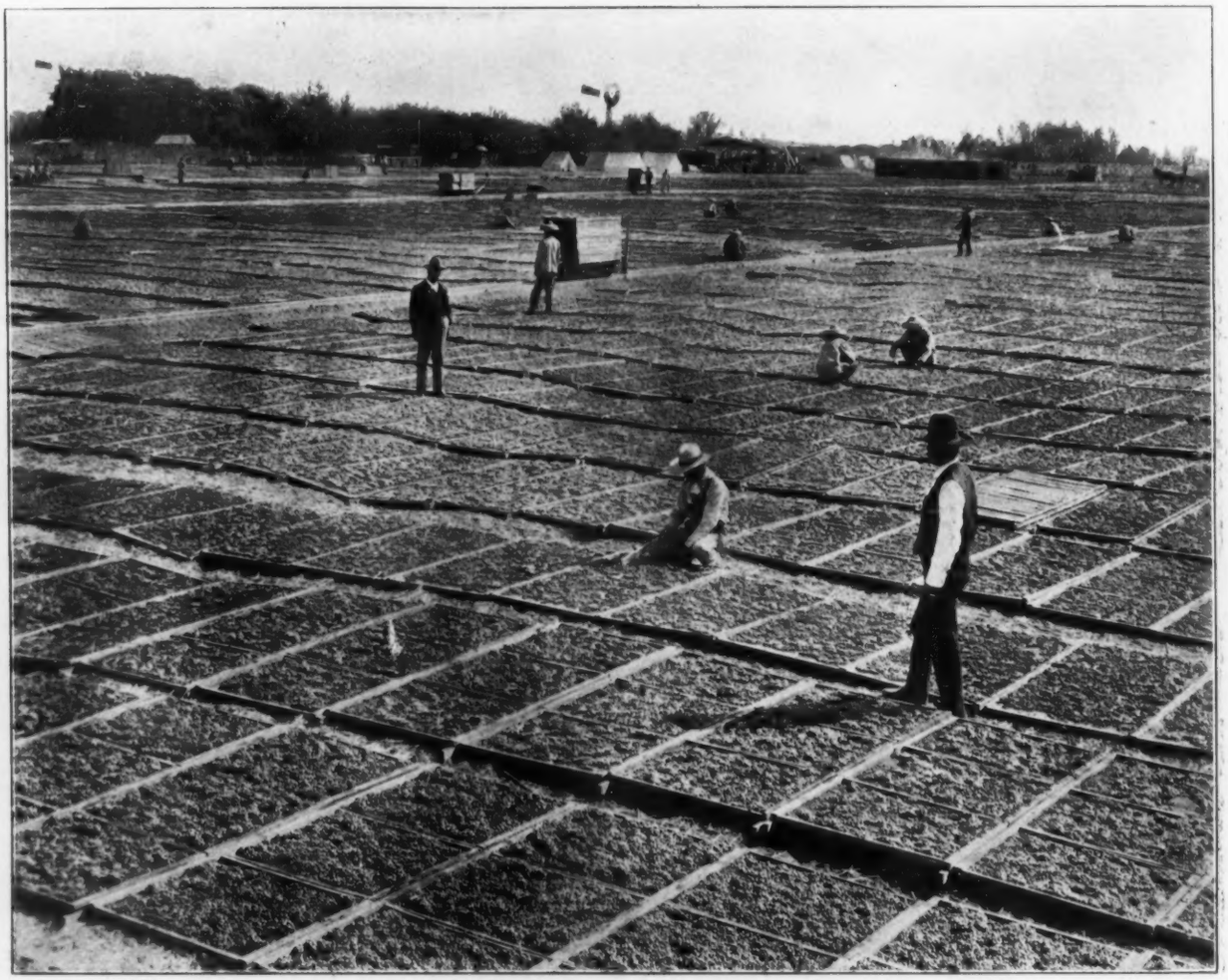
"Some Punkins"—Dividends (Alias Melons) $350,000 Worth Last Year

Retrospective, Prospective and Statistical

The oldest inhabitant of Fresno need not be of very mature age. The man of forty can well remember when the Southern Pacific laid the rails through the San Joaquin in 1872, thus giving an excuse for a station on the line called Fresno. To a Californian this thirty-six years since seems much more than enough to build a city of twenty times the size of Fresno, with its 35,000 inhabitants. It is, however, a matter of wonderment to note the agricultural development of the section lying around the city, threaded by the wires of the San Joaquin Light and Power Company, not only in Fresno, but in neighboring counties. This section can undoubtedly prove a greater agricultural development and production in dollars per capita per year than any other district of equivalent area. The ratio, as near as can be calculated, is quite near to $41,000,000, divided by 50,000 souls, or about $820 per capita per annum. A combination of many causes is responsible for such progress, the most potent being fertility of soil, an abundance of water in an ample irrigating canal system, a favorable climate and geographical situation to preside over the commerce of the San Joaquin Valley, quite level and hence easily irrigated lands, an energetic people, and last, but not least, cheap and available electric power.

Fresno is not only feeling a *vis-a-tergo* from the importation of this $41,000,000 per year to pay for the crops and products sent to many foreign and domestic parts, but also on account of the importation of nascent moneys for the development of large new tracts of land of the general type of the Redbanks Orchard Company's properties on the Cottonwood.

These fertile foothill slopes above the frost, and also above the irrigating canals, are especially adaptable for citrus fruits as well as all kinds raised down on the lower levels. Lands of this kind are of sufficient acreage to demand from 50,000 to 75,000 horsepower for their development, and in the industries which would appertain thereto, lands which are absolutely dependent for all time upon power for their cultivation and their commercial existence.



Several Acre-feet of Raisins. $6,500,000 are the Season's Returns

COMBINED STATEMENT OF BANKS

In Fresno, Kings, Tulare and Madera Counties, California, August 22d, 1907.

Resources.

	Loans and Discounts.	Bonds.	Bank Prms. and Other Rl. Est.	Cash on Hand and in Bank.	Totals.
Fresno County	$6,377,328.75	$1,447,318.24	$373,128.52	$2,265,660.15	$10,463,435.66
Kings "	2,368,467.29	105,250.89	152,053.61	847,892.38	3,473,664.17
Tulare "	2,894,740.06	433,937.46	231,236.81	1,222,558.85	4,782,473.18
Madera "	295,100.32	18,594.85	5,848.65	316,488.83	636,032.65
Totals	$11,935,636.42	$2,005,101.44	$762,267.59	$4,652,600.21	$19,355,605.66

Liabilities.

	Capital Stock.	Surplus & Und. Prfts.	Bank Notes Outstanding.	Deposits.	Totals.
Fresno County	$1,460,000.00	$575,421.74	$275,250.00	$8,152,763.92	$10,463,435.66
Kings "	485,000.00	224,416.61	62,500.00	2,701,747.56	3,473,664.17
Tulare "	545,500.00	584,953.53	90,000.00	3,562,019.65	4,782,473.18
Madera "	75,000.00	44,667.27	6,300.00	510,065.38	636,032.65
Totals	$2,565,500.00	$1,429,459.15	$434,050.00	$14,926,596.51	$19,355,605.66

Total population four counties, about 95,000.

COMBINED STATEMENT OF BANKS

In Fresno, Kings, Tulare and Madera Counties, California, December 3d, 1907.

Resources.

Fresno County	$7,053,563.74	$1,545,510.61	$391,632.14	$4,563,320.91	$13,554,027.40
Kings "	2,389,080.06	121,929.00	157,401.36	869,211.40	3,537,621.82
Tulare "	3,096,003.42	422,179.27	248,469.82	1,396,768.98	5,163,421.49
Madera "	310,019.89	18,576.76	6,114.65	266,242.51	600,953.81
Totals	$12,848,667.11	$2,108,195.64	$803,617.97	$7,095,543.80	$22,856,024.52

Liabilities.

Fresno County	$1,635,000.00	$860,196.92	$419,250.00	$10,639,587.63	$13,554,034.54
Kings "	485,000.00	248,213.94	71,050.00	2,733,357.88	3,537,621.82
Tulare "	604,125.00	616,706.49	90,000.00	3,852,582.85	5,163,414.34
Madera "	75,000.00	49,386.85	6,300.00	470,266.96	600,953.81
Totals	$2,799,125.00	$1,774,504.20	$586,600.00	$17,695,795.32	$22,856,024.52

Total population four counties, about 95,000.

The impetus given to the Calmyrna fig industry by Mr. Roeding, of Fresno, who studied the cultivation in the native country of Symrna, as mentioned in the introduction, is shortly to add much credit to this well-adapted district.

The cultivation of the olive is also of growing importance, 1,000 gallons of oil being produced last year.

These and many other facts naturally turn one's attention to those who have to do with the large sums of money necessary to handle the crops. During the late financial unpleasantness this section was quite oblivious of its existence, as a study into bank statistics, made by the examiners at the time, indicated in the first call of statements from the national banks, in December, 1907, a more healthy condition than in the preceding August reports.

Fresno Street Scene

BOOKS RECEIVED.

"Principles of Alternating Currents." By E. G. Larner, A. I. E. E. of the Engineering Department G. P. O., London. Published by D. Van Nostrand Company, New York, and by Crosby, Lockwood & Son, London. Size, 4½x7 inches; pages 8 to 132; 72 diagrams. Price, $1.50, net.

In this volume the author presents a non-mathematical treatment of the theory of alternating currents. As a preliminary, he explains the principles of simple harmonic motion, and their application, giving a graphical representation. He continues with a full description of the motion of vectorial representation, and then develops the theory of alternating currents. The author includes a general discussion on alternating-current powers. The treatment seems verbose, and is likely to involve a novice into complexities, which a simpler and more condensed treatment might avoid. There have been many attempts to explain alternating currents without the use of mathematics, but it seems to us that a man who is likely to make very much use of the theory of alternating currents would do well to devote a little preliminary study to the integral calculus. The book contains little that is new, and seems admirably adapted to confuse, rather than aid, the beginner.

"Electric Motors—Their Installation, Control, Operation, and Maintenance." By Norman G. Meade. Published by McGraw Publishing Co., New York. Size, 4½x7½; 155 pages; green cloth; 126 diagrams. Price, $1.00, net.

This is an excellent book for a man having anything to do with electric motors. The author describes the leading motors, and gives valuable practical suggestions for their installation, care, and management. This is a text-book from which mathematics have been eliminated to a very great extent, the author depending upon graphical motions to convey his meaning. In a compact form it contains a great deal of interesting matter which few electricians can afford to overlook.

DUTY OF GAS AND ELECTRIC CORPORATIONS IN CALIFORNIA TO FURNISH LIGHT FOR PUBLIC USE.

By Emerson W. Read, B.L., L.L.B.
(Member of the San Francisco Bar.)

The obligation of public-service corporations to furnish their commodity to owners and occupants of buildings situated along the mains or wires of such companies, has been previously called to the attention of readers of these columns. Then, the obligation was described and shown in its general application to all the States, in statutory as well as common law.

In California, particularly, the duty and obligations of such companies are well laid down in the statutes, and now construed in six or seven appellate decisions hereafter briefly referred to.

The Civil Code of California provides:

> "Upon the application in writing of the owner or occupant of any building or premises distant not more than one hundred feet from any main, or direct or secondary wire, of the corporation, and payment by the applicant of all money due from him, the corporation must supply gas or electricity as required for such building or premises, and cannot refuse on the ground of any indebtedness of any former owner or occupant thereof, unless the applicant has undertaken to pay for the same. If, for the space of ten days after such application, the corporation refuses or neglects to supply the gas or electricity required, it must pay to the applicant the sum of fifty dollars as liquidated damages, and five dollars per day as liquidated damages for every day such refusal or neglect continues thereafter."

Originally this section of the Code so read as to apply only to gas companies. The Legislature repealed the section as it then stood and re-enacted it in a more inclusive form, that is, by making it read "one hundred feet from any main, or direct or primary wire, of the corporation," where it had read, "one hundred feet from any main of the corporation." The primary purpose of this amendment was to make the section applicable to electric as well as gas-light corporations.

The section of the Code above set forth (Sec. 629, C. C.) was drafted with full knowledge of certain difficulties which had previously arisen in Common Law States over this duty of such companies. One of these, to illustrate, is recalled by the words, "and payment by the applicant of all moneys due from him." In Beale and Wyman—"Cases on Public Service Corporations," appears a collection of cases illustrating some of the difficulties experienced by the corporations, the consumers, and the municipal governments over this particular duty of indiscriminate service. One collection contained cases wherein the defendant corporation had shown that it had previously furnished its product to this particular applicant, and that the applicant had failed and neglected and even refused to pay for the corporation's services and product furnished on the former occasion. Did this past neglect constitute legal grounds upon which the corporation could justly and lawfully refuse to supply its commodity? Many cases of this kind arose. In California, it is seen, the statute, drawn with this question previously contemplated, has anticipated such legal question and enacted that "payment by the applicant of all money due by him" be made before the corporation can be required to furnish its product to him.

The first decision under this section of the Code in California was Capital Gas Co. v. Young (109 Cal. 144). In that case, Searls (C.) said: "Under the operation of this law the gas company was not a free agent with power to contract or refuse to do so, but it became its duty, upon demand, to furnish gas to the city, . . . This duty to furnish gas to the city devolved upon the respondent, not by virtue of any contract, but by operation of law, and hence the laws governing ordinary contracts resting in the volition of the parties thereto has no application." In Smith v. Capital Gas Co. (132 Cal. at p. 212) an action was brought under this section of the Civil Code to recover the liquidated damages provided by that Code where the corporation refused to supply gas. The corporation defended by alleging that the applicant failed to "furnish a meter, or agree to pay defendant fifty cents per month as rent for a meter." Speaking of this defense, the decision states: "There can be no doubt, I think, of the right of gas companies, ordinarily, to charge rent for meters. But the point is made by appellant, that, in charging him with such rent, when other consumers were not compelled to pay it, 'the defendant arbitrarily discriminated against the plaintiff.' But I do not htink this is the case. Ordinarily, compensation for the meter is received from the return for the gas consumed. But here the value of the gas consumed during the year previous to the removal of the meter was not equal to a one-sixth part of the annual expense of the meter. There can be no question that the intention was that plaintiff would take gas from defendant, for he expressly agreed so to do, and that defendant should supply it at the rate agreed upon, so long as plaintiff should use it, for defendant so expressly agreed, and so long as plaintiff took the gas, defendant could compel payment at the agreed rate. It was, indeed, not necessary that defendant should agree to supply the gas, for this was its duty under the statute. It could only fix the rate and enforce reasonable regulation as to the service. The obligation of defendants to supply property-owners within the statutory limits of defendant's mains, as we have seen, results from the statute, and not from contract." (Gallagher v. Equitable Gas Light Co., 141 Cal. 706.)

However, the Code has taken the precaution to protect the corporation in cases where Section 629 cannot reasonably be invoked. Section 630 of the Civil Code provides:

> "No corporation is required to lay service pipe where serious obstacles exist to laying it, unless the applicant, if required, deposits in advance, with the corporation, a sum of money sufficient to pay the cost of laying such service pipe, or his proportion thereof."

This is a seemingly reasonable provision of the law. No occasion has yet arisen wherein it has been found necessary to construe this section. Just what would amount to a serious obstacle has never been legally determined in this connection by an appellate court of this State. A case presents itself, however, in an attempt by an applicant to compel a gas company to lay pipes in a small street or alley not yet dedicated to public use, having many of the features of a public thoroughfare, though as yet claimed by private interests.

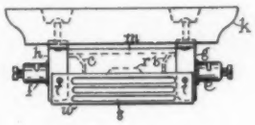
> "No corporation is required to construct lines for the supply of electric current for light where serious obstacles exist, nor shall such corporation be required to supply such current from a direct wire at a distance too remote from the generating station, to insure a sufficient supply; nor is such corporation required to supply electric current for light from a primary wire carrying current of high voltage, unless the applicant deposit, in advance, a sum of money sufficient to pay the actual costs of such construction and for the appliances required to supply electric current with safety at the proper voltage." (Sec. 630a, C. C.)

This section applies to electric lighting facilities, and was enacted to supply the deficiency existing in Section 630 (above quoted) which, it is seen, was enacted to cover only lighting by gas. Both sections read together cover the field of artificial light supply by corporations of a public-service nature.

PATENTS

THERMOSTATIC CIRCUIT-CONTROLLER. 903,165. George H. Bowen, Boston, Mass. Filed June 20, 1907. Serial No. 379,896.

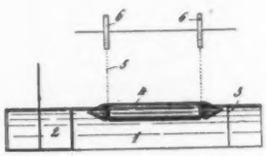
The combination with a thermostatic circuit controller comprising a movable rod movable in a direction transversely of its length, and circuit terminals with which it co-operates,



of an inclosing tube for said rod extended over said terminals, a fusible support for said rod located in said tube and normally engaging the inner surface of the latter to hold the said rod out of contact with said terminals, supports for said circuit terminals, and a guard or shield for said tube secured to said supports, substantially as decribed.

ELECTROLYTIC APPARATUS. 903,164. Paul Borgnet, Liege, Belgium. Filed May 11, 1907. Serial No. 373,158.

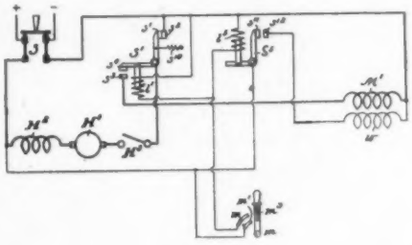
In an apparatus for electro-deposition, a vessel for containing the electrolyte, a cathode arranged to float unsup-



ported in the bath, an anode in the bath arranged in proximity to the floating cathode, a conductor arranged to bear against the cathode, and means on the cathode for causing its rotation from the movement of the electrolyte.

LIFTING-MAGNET. 903,552. Arthur C. Eastwood and Frederick R. Fishback, Cleveland, Ohio, assignors to The Electric Controller & Supply Company, Cleveland, Ohio, a corporation of Ohio. Filed April 4, 1908. Serial No. 425,135.

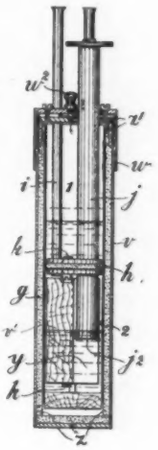
In combination with a lifting magnet, means for causing the excitation of the magnet to be at a maximum at the in-



stant of lifting the load irrespective of fluctuations in the voltage at which current is supplied to the winding of the lifting magnet.

DEVICE FOR AUTOMATICALLY LIGHTING AND EXTINGUISHING GAS-LIGHTS BY VARYING THE PRESSURE IN THE MAINS. 903,633. John M. Tourtel and William R. Mealing, London, England. Filed Dec. 21, 1907. Serial No. 407,513.

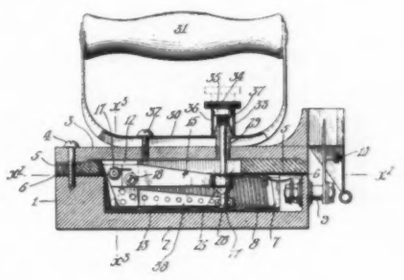
A gas-controller operated by temporary surplus gas-pressure, consisting of a casing divided into a lower, liquid-containing chamber and an upper chamber superimposed upon



the lower chamber, the upper chamber being open to the air, means for supplying gas under pressure to the lower chamber; a tube connecting the two chambers and through which liquid passes from the lower to the upper chamber under the action of the gas pressure, and an adjustable outlet-tube communicating with the lower chamber and normally sealed by the liquid therein and adapted to be opened by passage of liquid from the lower to the upper chamber.

THERMOSTAT FOR ELECTRIC HEATERS. 903,319. Earl H. Richardson, Ontario, Cal., assignor to Pacific Electric Heating Company, Ontario, Cal., a corporation of California. Filed Jan. 2, 1908. Serial No. 409,093.

In combination, a hollow body, a pair of heating units therein, a removable cover on the body, a supporting bracket depending from the cover, a pair of contact blades between



the heating units and supported by said bracket, each blade being electrically connected with a heating unit, a temperature operated detent blade attached to the bracket and extending between the heating units, a stem slidably mounted in said cover, a plug on the stem normally lying between the contact blades, the stem having an abutment normally engaged by the detent blade and spring means supported by the cover and exerting an upward pressure on the stem.

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Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

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Electricity in San Joaquin Valley

Reference to the map of California shows that nearly one-fourth its area is contained within the great valleys of the Sacramento and San Joaquin Rivers. This vast amphitheater lies between the snow-clad heights of the Sierra Nevada Mountains on the east and the Coast Ranges on the west, with an average width of sixty miles, and runs for over five hundred miles from Mr. Shasta on the north to the Tehachapi on the south. It was the scene of the first successful long-distance transmission of hydro-electric power for industrial purposes in the United States, and today within its confines there are about one-quarter million electric horsepower being developed by means of water.

Water has always been the prime factor in the production of power. Thousands of years ago primitive man made his simple forms of current-wheels and utilized the energies of the river to raise its own water and convert the desert into a garden. As these early means were at best inefficient in action, they were displaced by steam power, which in itself is dependent upon water. Finally, with the development of electricity, it became possible to utilize at a distance the power generated by falling water, and now the delicate mechanism of the dentist's drill and the most powerful rock crushers are alike driven by its force. To one who can read between the lines, the description of a modern hydro-electric plant means far more than a mere catalogue of apparatus for utilizing and distributing power. It represents the prophetic confidence of courageous men in the latent possibilities of a country. It is the embodiment of years of patient endeavor in the development not only of power, but also of a market that will consume that power.

In the central valley of California, the power that has already been developed is but an infinitesimal part of what it is capable of yielding. Plans have already been completed for the generation of as much more, and it will be but a few years before one million horsepower will be the daily output. This is due not only to the geographical relief, from which result abundant water and great difference in elevation, but also to a fertile soil and a beneficent climate that supports industries and people who will use that power. One of the most important of these uses will be the pumping of water to the thousands of acres which now lie above the level of the irrigating canals.

At less than the cost of keeping a team of horses a twenty-acre farmer can get current which will irrigate his land, light his buildings, and do his chores. By means of the electric telephone, he is in close touch with the markets, and may be warned of approaching storms or impending frosts. The electric railway will give him rapid and cheap transportation; all of which tends to idealize country life.

PERSONAL.

J. A. Cranston, manager of the Portland office of the General Electric Company, is in San Francisco.

C. R. Downs, of the Amador Electric Light & Power Company, has been visiting in San Francisco, from Sutter Creek, California.

Ralph L. Phelps, the San Francisco manager of the Safety Insulated Wire & Cable Co., is the proud father of a seven-pound baby girl.

C. L. Eshleman, of the Jandus Electric Co., of Cleveland, Ohio, has spent the past week with their Pacific Coast representatives, the Standard Electric Co., of San Francisco.

J. R. Gordon has accepted the position of manager of power apparatus sales for the Western Electric Company for its Southern territory, with headquarters at Atlanta, Georgia, having resigned as manager of the Southern States for the Westinghouse Electric & Manufacturing Company.

R. P. Valentine, superintendent of the gas works of the Sacramento Electric, Gas & Railway Company, has resigned his position to accept the position of manager for the Marin County Gas Company, recently organized at Sausalito. William Henderson has succeeded Mr. Valentine with the Sacramento Electric, Gas & Railway Company.

The founder's day address of the twelfth anniversary of the Thomas S. Clarkson Memorial School of Technology, of Potsdam, N. Y., was delivered by Samuel Wesley Stratton, Eng. D. (Illinois), Sc. D. (Cambridge), Director Bureau of Standards, Department of Commerce and Labor, Washington, D. C., on December 1, 1908.

MEETING OF THE EXECUTIVE COMMITTEE OF THE NORTHWEST LIGHT AND POWER ASSOCIATION.

SPOKANE, WASH.—Harry L. Bleecker, secretary of the Washington Water Power Company of Spokane, and chairman of the Executive Committee of the Northwest Electric Light and Power Association, has called a special meeting of the last-named organization, for December 18, at Portland, to discuss a plan to familiarize Eastern investors with the opportunities in the smaller towns in the Northwest, especially in places where electric power may be distributed for irrigation purposes. The larger cities have been provided for. The committee will also take up the question of establishing a uniform rate for electric lighting companies in these towns, where some concerns are running at a loss, while others are making overcharges. A publicity company is planned under the supervision of the association, for the development of the entire Northwest, the territory embraced including Washington, Idaho, Northern Oregon, and Western Montana. Important improvements and necessary extensions for the smaller towns of this territory have been handicapped by lack of capital, and the failure heretofore to convince Eastern capital of the marvelous possibilities and fields for investment in electrical securities. Eastern capital is shy of these securities in towns of 4,000 and 5,000, comparing Western cities with those of the same size in the East, which, instead of increasing, show less population, sometimes, at the end of ten years, while the reverse is true of Western cities, which forge ahead with tremendous strides.

MEETING OF SAN FRANCISCO SECTION A. I. E. E.

A meeting of the San Francisco Section A. I. E. E. was held in the Assembly Room of the Cal. Gas and Electric Corporation, No. 925 Franklin Street on Friday, November 27, 1908, at 8 p. m. Mr. C. W. Bartholomew, Western manager of the Westinghouse Air Brake Co., gave an informal talk on Air Brakes for Freight and Passenger Trains; what the air brake is, what it does, how it does it, and what happens under the many emergencies of train operation. As the result of a postal card election the following Executive Committee for 1909 was announced: S. J. Lisberger, engineer, California Gas and Electric Corporation; C. W. Burkett, chief engineer Pacific Tel. & Tel. Co.; K. G. Dunn, engineer, Hunt-Mirk Co.; W. J. Davis, engineer General Electric Co.; W. T. Bivins, chief engineer United Railroads.

BOOKS RECEIVED.

The Canal Zone. By Thomas Graham Grier. Bound in cloth, 9¼-inch by 6¼-inch; 150 pages; 200 illustrations and maps. Price, $1.00, postpaid: Thomas G. Grier, 128 West Jackson Boulevard, Chicago, or the Technical Book Shop, 111 New Montgomery Street, San Francisco, Cal.

Thomas G. Grier, an electrical man of Chicago, who is well known on the Pacific Coast, is somewhat of a globe trotter, and he has a very pleasant habit of recording his experiences in a way which makes very interesting reading. He recently made a trip to the Isthmus of Panama, and spent some time there investigating the condition of the work now in progress, and the result of this trip is an unusually attractive book written in a very chatty personal way, which not only covers details of the Canal work and the manner in which it is being handled, but also enters intimately into the lives of the people who are temporarily living on the Canal Zone in charge of this work. In strong contrast with his early history of old Panama during the days of the buccaneer, is his description of conditions of the present day and the multitude of men and the modern machinery, who are accomplishing something which will in future be looked upon as one of the wonders of the present century. The numerous illustrations and maps with interesting data add largely to the value of a work which is of peculiar interest to the people of the Pacific Coast, who have much to expect from the completion of this great work.

TRADE CATALOGUES.

High-class direct-current switchboard panels manufactured by the Crocker-Wheeler Company, Ampere, New Jersey, are described in their Bulletin No. 106, recently issued. This bulletin has illustrations of a large number of standard switchboard panels which can be assembled together to form a switchboard of any size and capacity. The bulletin fully describes these panels, and contains valuable suggestions as to the instruments and apparatus necessary on switchboards.

Bulletin No. 4627, recently issued by the General Electric Company, Schenectady, N. Y., contains matter descriptive of the company's curve drawing instruments for alternating and direct-current circuits. These instruments, though they have been in commercial use for several years, have been recently improved by the General Electric Company, and the illustrations and descriptions contained in the bulletin will be found to be of special interest. The bulletin contains, also, connections, dimension diagrams, and prices.

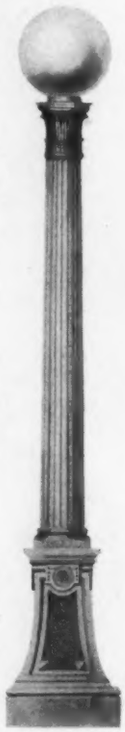
The Brown Hoisting Machinery Co., of Cleveland, Ohio, have just issued a new bucket catalogue. This catalogue covers thoroughly the product of this company in this line.

The two rope buckets are pictured in use on many different types of machines. The "Brownhoist" single rope buckets for use on existing machines, having but a single drum engine, are also described and pictured. Automatic dumping tubs, shovel buckets, etc., are also shown.

INDUSTRIAL

ARTISTIC BOULEVARD AND STREET LIGHTING.

The accompanying illustrations show two designs of columns used with the Daniels Boulevard Lighting System. This system was developed in connection with extensive electrical improvements made by several Chicago Park Commissions, and is today not only considered the most artistic, but the most economical of any ornamental lighting system. The small illustration shows the method of enclosing an arc lamp mechanism within a 20-inch opalescent globe. By the use of a light opalescent inner globe and light opalescent 20-inch enclosing ball, excellent distribution of light is obtained—eliminating all shadows and producing a clear diffusion of light, heretofore unequalled. By the use of a high-candlepower unit of light evenly diffused a less number of units is required with a corresponding reduction in first cost and maintenance charges.



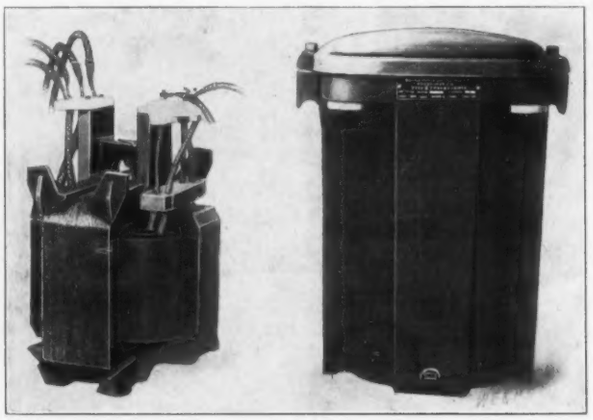
The columns are made of reinforced concrete, pressed steel, pressed copper, bronze, or cast iron. The concrete columns are admirably adapted to the Boulevard System on account of their susceptibility to any natural finish. The standard finish is sand-stone, and other special finishes are marble and granite. By the use of white sand and white cement, concrete posts can be made to correspond with the architecture of any building.

The manufacturers of this system, the Jandus Electric Company, Cleveland, Ohio, have recently been successful in making an arrangement whereby they hold sales rights on pressed steel and pressed copper columns for the Daniels Ornamental Arc Lighting System. As the process of pressing sheet steel and sheet copper into ornamental standards is somewhat new, the trade will no doubt be interested to learn of the novel method of post manufacture. For many years attempts have been made to press sheet steel or sheet copper into circular fluted poles, and at the same time produce a taper from the base to the top, thus forming a column of purely classical design. This question has now been solved, and the accompanying illustration will show two views of the pressed copper or steel post manufactured by this patented process.

The Daniels Ornamental Street and Boulevard Lighting System has an important function to perform, and its establishment in the lighting field not only insures better illumination, but heralds the disappearance of antiquated and barbaric productions in lighting fixtures. The lighting of boulevards, parks, public squares, public buildings, capitol grounds, business blocks, private drives, amusement parks, and many other applications, fall within the sphere of the Boulevard Lamp. Detailed information and estimates on the Daniels Boulevard Lighting System will be furnished by the Standard Electrical Works, Pacific Coast agents of the Jandus Electric Company.

THE WESTINGHOUSE TYPE S DISTRIBUTING TRANSFORMERS.

The introduction of alternating current into America by the Westinghouse Company necessitated the design and manufacture of apparatus never before attempted in this country. Realizing that the transformer was one of the elements most vital to the successful operation of alternating current systems, a staff of special engineers devoted its entire attention to the development of this apparatus at a time when other manufacturers were condemning alternating current systems and attempting to secure legislation against their use. The Westinghouse engineers thus were pioneers in transformer development, and their long experience and unparalleled facilities for investigation and research have enabled them always to produce transformers of the highest quality.



Transformer practice has changed as alternating current engineering has developed, and as a result, each line of transformers has been succeeded by another line, improved in some essential detail. The direct outgrowth from these older lines of transformers is the present type of construction which includes only those points which have proved a success in former lines.

These transformers are the result of exhaustive electrical research and a careful study of the mechanical design best suited for this service. The shell type of construction, as embodied in the type S transformer, has been demonstrated by mathematical analysis and by test results as being the pinnacle of transformer progress, and it is notable that leading transformer manufacturers now acknowledge the shell type of construction as affording the nearest approach to the perfect design. The type S transformer employs a multi-circuit magnetic path, the distinguishing characteristic of the shell type construction. They are built in fifteen sizes, from one to fifty kilowatts, inclusive.

These transformers are designed for supplying 110 and 220-volt service from primary circuits of nominal 1,100 and 2,200 volts. Excellent results, however, can be obtained with high-tension voltages between 1000-1200 and 2000-2400 volts. Another line (class 400) is arranged for supplying 220-440-volt service. The normal frequency is sixty cycles (7,200 alternations), but their design contemplates us on circuits of any frequency from 50 to 140 cycles.

NEWS NOTES

TRANSMISSION.

GEORGETOWN, CAL.—Norvall Douglass, Jr., has appropriated water from Bear Creek for the operation of a small electrical plant for mining purposes.

FRESNO, CAL.—J. W. McLaughlin and C. K. Kirby have appropriated 300,000 inches of water from the San Joaquin River for electric power purposes.

TONOPAH, NEV.—The Nevada-California Power Company is making a preliminary survey for an extension of its line from this place to Manhattan and Round Mountain.

BAKERSFIELD, CAL.—The Board of Supervisors have continued to the December meeting the matter of awarding an electric transmission franchise in the vicinity of Delano.

KIONA, WASH.—Surveys have recently been made through Kiona by a crew of men representing the Electric Light & Power Company of North Yakima. This line is to connect the principal towns of Benton County.

SAN FRANCISCO, CAL.—The managers of Agnews State Hospital are advertising for bids for the furnishing and erection of a complete power plant in the State institution at Agnews, Cal., bids to be opened December 16th. Plans are on file with Sellon & Hemmings, 244 Kearny Street, San Francisco.

TACOMA, WASH.—Stone & Webster are to begin soon the construction of a power plant at Lake Tapps to develop 200,000 horsepower, according to the report of a representative of one of the large contracting firms, who was in Tacoma recently, and who states that the plans have all been made and that the development of the project will be at once taken up.

WENATCHEE, WASH.—J. H. Stout, secretary and treasurer of the Entiat Power Company, has opened an office in the Columbia Valley Bank Building at Wenatchee, Wash., which will be headquarters. The company has a large force of men at work on its power line, which will reach Wenatchee before the end of the year. Progress is also made on the power house on the Entiat River.

RED BLUFF, CAL.—The Northern California Power Company has begun operations in the vicinity of Manton, and is now at work on the ditch which will bring water from Battle Creek to the powerhouse, which will be built about one mile above the Battle Creek bridge. A machine and boiler shop is also under construction. The company has bought several rights and ditches formerly used for irrigation purposes, and will turn all of the water back into the creek in order to increase the amount available for power.

HUSUM, WASH.—The Husum Power Company, owned by J. T. Thompson and Martin Thompson, will construct a plant at Husum, Wash., to supply electricity and power for all purposes. The company already has a force excavating and blasting a race below the White Salmon Falls, in which a turbine of 300 horsepower will be placed. There will be a 16-foot pressure of 600 cubic feet of water per second. The company will supply the city of White Salmon, eight miles, with arc and incandescent lighting. Power will also be furnished to the ranches in the vicinity of Husum, for irrigating purposes, as well as supplying electric lights. It is expected that in time a power line will be run to Trout Lake, for manufacturing purposes.

YAKIMA, WASH.—Robert E. Strahorn, of Spokane, president of the North Coast Railway Company, announces that within four months a plant will be in operation at North Yakima, Washington, transmitting 10,000 horsepower of electricity through the valley, over a line ninety miles in length, with numerous branches. The project involves an expenditure of $500,000. He added: "So far as the Yakima Valley is concerned, it is obvious that this is but the forerunner of millions of dollars which will be invested otherwise. The transmission of power will bring into existence numerous small plants which are now impossible and which would be impossible if small isolated plants were established, as these plants could not sell day power. Our power will be sufficient to place 25,000 acres of land under irrigation. In other ways the transmission of power will work a great change. Small towns and communities now without fire-fighting or water-supply services will be able to procure the necessary power. In other words, electricity is soon to reach its highest development in the valleys of the Columbia and Yakima Rivers."

TRANSPORTATION.

HUNTINGTON BEACH, CAL.—Chief Engineer Pillsbury, of the Pacific Electric Railway Company, has decided upon the route to be followed by the new Santa Ana line from Talbert to the sugar factory.

SAN FRANCISCO, CAL.—Advices from Boston say that the reports of the placing of a $5,000,000 Harriman contract with the General Electric Company for work on the Pacific Coast, are without foundation.

ROSEBURG, ORE.—The Alameda Consolidated Mines Company is arranging for the development of a water power of from six to eight thousand horsepower; also to build an electric road to some convenient point on the Southern Pacific railroad.

KINGSBURG, CAL.—F. S. Gronger, who is promoting the new electric railway in this section of the State, has announced that a power house will be built here for the operation of the line. The plant will, it is given out, cost in the neighborhood of $100,000.

SEATTLE, WASH.—By the reorganization of the Seattle & Everett Interurban line, which passed into the hands of the Puget Sound International Railway & Power Company, another step was taken toward extending what is now and was intended as a suburban line, into a railway which is ultimately to skirt the Coast from Seattle to Vancouver, B. C.

BERKELEY, CAL.—The City Council has granted the Key Route Company the Sacramento Street franchise recently petitioned for. It runs for forty-eight years and authorizes the company to construct and operate its system from the Oakland line north to Peralta Street, about four miles, with a northeasterly extension as far as Monterey Avenue, and the extension of Grove Street. The estimated cost of the new line is $1,600,000.

Priest Rapids Project.—The General Land Office has approved the location of an electric railway along the Columbia River, from the foot of Priest Rapids to White Bluffs, Wash. This is part of a road to be built between Wenatchee and Kennewick, crossing the country from Kennewick to Walla Walla. The project is of importance, and the approval of the location indicates that the actual work of building will soon begin. It is not known just what interests are back of it, but there are reports that it will be in operation before the construction of the North Coast road, which will follow the Columbia River for the greater part of the distance. The power to operate the line will be generated at Priest Rapids. It is estimated there is sufficient power in these rapids that may be harnessed to operate the entire line and have enough to furnish the light and power for every place that may be established along the line.

WALLA WALLA, WASH.—Farmers' Electric Railway.—Prominent members of the Farmers' Union in the Walla Walla district, taking in Walla Walla and Columbia Counties in Washington and Umatilla County in Oregon, south of Spokane, purpose to build a line in that territory. This road will be graded by the farmers, who will receive stock in the company for their labor. The right-of-way will then be used as security for bonding the company for enough to lay ties and steel and furnish equipment. The line will join Walla Walla with Wallulla and connect with boats on the Columbia River. It is likely that the power plant will be erected on the Tukanon River, fifteen miles above Dayton, Wash., where engineers say power can be generated cheaper than anywhere in the Northwest. The plan of building a steam road and afterward electrifying it, is meeting with opposition on account of the high cost of making the transfer and loss in way of equipment, and it is likely that electricity will be used at the beginning.

SPOKANE, WASH.—The City Council has recommended the Spokane Traction Company's pending ordinance out for passage at the regular revenue return of two mills the car-mile to the city. The matter came up on petition from hundreds of residents, who asked that the company be given additional franchises in their neighborhoods. Jay P. Graves, president, said the new lines would be built only on the passage of the two-mills revenue rate. The franchise calls for a line starting at Sprague Avenue and Freya Street, extend east to the eastern city limits. Another extension would begin at Fifth Avenue and Regal Street, extend east to Freya Street and south to Eleventh Avenue. Another would be from Southeast Boulevard and Hatch Street, southeast to Sixteenth Avenue, east to Pittsburg Street, to Seventeenth Avenue to Crestline Street and to Ray street, with a Y on Ray Street. Another would be from Ninth Avenue and Grand Street, to Hill Avenue, to City View Street, to Rosedale Boulevard, to Hatch Street. The committee also recommended a franchise for passage providing for switches and turnouts in various parts of the city on the same system.

ILLUMINATION.

CARSON, NEV.—Louis A. Thomas, a well-known mining man, has asked for a 50-year franchise for a gas plant and distributing system in this city.

SAN FRANCISCO, CAL.—The San Francisco Gas & Electric Company will build a six-story brick structure on its lot on Sutter Street, near Powell, at a cost of about $75,000.

DOWNEY, CAL.—J. R. Gordon will commence at once to build and equip an electric-light plant here, in accordance with the 50-year franchise granted him by the Board of Supervisors last week.

VALE, ORE.—The Vale Light & Power Company has been reorganized, R. C. Carter, of Boise, Ida., having been elected president and purchasing controlling interest. Lighting plant will be overhauled and new machinery put in.

NAPA, CAL.—The plant and franchise of the Calistoga Electric Light & Power Company has been sold by the sheriff to satisfy the claims of San Francisco creditors. It was sold to William Spiers, of Lake County, for only $2,000.

TACOMA, WASH.—A definite step toward increasing the capacity of the city light plant was taken when the Council Committee on Fire and Water approved a resolution introduced by Councilman Armstrong recommending that the necessary proceedings be instituted for the construction of a hydro-electric power plant on the upper Nisqually River. This project is one that was recommended by the Board of Engineers which was appointed last year. The project calls for a 20,000-horsepower plant with a reservoir.

TELEPHONE AND TELEGRAPH.

PORT ORCHARD, WASH.—The Island Telephone Company has been granted a franchise by the Board of County Commissioners.

ALAMEDA, CAL.—The Chamber of Commerce of this place is agitating the question of requiring all electric wires in the city to be laid under ground.

VALLEJO, CAL.—The matter of building a private telephone line from this place into the American Canyon section is now being taken up. The move is favored by the Pacific Telephone & Telegraph Company.

HELENA, MONT.—Articles of incorporation were filed recently at the County Courthouse by the Marysville Rural Telephone Company. This new line will extend from Marysville to Canyon Creek and Silver or Johns.

NORTH YAKIMA, WASH.—Workmen for the Pacific States Telephone & Telegraph Company have begun removing all aerial lines on the west side of this city and substituting cables in their places. The improvement will cost $20,000.

RENO, NEV.—Key Pittman, President of the Southern Nevada Telegraph Company, has left for New York, supposedly to complete arrangements for the alliance between his company and the Postal system. The Nevada Guarantee Trust Company and Edwin Weed, of 10 Wall Street, New York, are attending to the financial end.

BISHOP, CAL.—Frank C. Sherrer, acting for the Owens Lake Telephone Company, has petitioned the Board of Supervisors for a franchise to construct and operate a system of telephone lines between Independence, Lone Pine, Keeler, Darwin, Skidoo and Ballart. Bids for the proposed franchise will be received to January 5th.

NORTH YAKIMA, WASH.—An independent telephone system that will connect North Yakima with the Selah and Wenas valleys and extend through them to the Kittitas County line, connecting with a system there, is assured. A franchise was granted by the Yakima County Board to W. F. Longmire, giving him the right to construct this system.

SAN FRANCISCO, CAL.—The Western Union Telegraph Company has begun suit against the Postal Telegraph Company to restrain the latter from re-dating all messages received from the Western Union at the cable terminals and making an extra charge of $1 per word, or $5 per message. A temporary injunction has been secured restraining the Postal Company from making the charge until the matter can be adjudicated in court. The Western Union is also retaliating by making a similar extra charge on all messages received from the Postal Company for transmission to Mexico, and had refused to accept messages from the Postal for inland towns except where these are delivered to the Western Union at the point where received.

WATERWORKS.

PLACERVILLE, CAL.—The management of the Placerville Waterworks has informed the City Trustees of this place that a number of improvements in the system are to be made at once. These include two new storage reservoirs, the replacing of a six-inch main on Main Street with an eight-inch main, and the placing of a new service main in Upper Placerville. The total cost of the changes will be about $8,000.

CORONA, CAL.—Edward Bonfoey has bought ninety-five acres of land near here, which he will improve. A pumping plant and 4,000 feet of surface pipe will be required.

YUBA CITY.—According to the plans of Engineer McMurtry, which have been accepted by the City Trustees for the proposed municipal waterworks, the plant, including a steel water tower 119 feet high, will cost about $30,000. The City Council has ordered bids for the work to be advertised for, to be opened December 7th.